PUBLIC HEALTH

REPORTS AND PAPERS

VOLUME III

PRESENTED AT THE MEETINGS OF THE

American Public Health Association

IN THE YEARS

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WITH AN ABSTRACT OF THE RECORD OF PROCEEDINGS
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INTRODUCTORY NOTE

BY THE SECRETARY OF THE ASSOCIATION.

THE third volume of papers and transactions of the Public Health Association comprises such completed contributions as the Publication Committee found at the beginning of the year 1877, in a suitable state to be issued together. Numerous papers of interest and value, but more or less incomplete or merely suggestive, have been given to the public journals in such manner as to best serve the purpose for which their authors contributed them to this Association at its annual meetings; and these, with other incomplete, though greatly appreciated offerings, are omitted from this volume. The Minutes of the Fourth Annual Meeting are presented in an abstract form. But the notes of the discussions upon the various topics are necessarily excluded. These, like the papers that are omitted, were amply reported by the daily press at the time of the meeting.

During the past year, the public attention to practical applications of sanitary knowledge has kept pace with the rapid growth of it and the methods of public health service. While physicians and naturalists are steadily pushing their researches to useful conclusions in regard to the phenomena and causation of destructive maladies, and are discovering their controllable factors of propagation, the State and local boards of health, the sanitary inspector and the engineer, the public economist and the philanthropist have appealed to the resources of hygiene, and turned them to use, with constantly increasing success, for the protection of human life and health. The domestic pests, — of which scarlatina and diphtheria are most dreaded, — the insidious infection and diffusion of the enteric typhoid poison, the self-propagating scourge of yellow fever which decimated Savannah, and, in a single month, nearly destroyed the households of Brunswick in Georgia; the disabling and impoverishing entailments of malarial regions and undrained towns, the removable sources of tubercular phthisis, the many causes of infant mortality, the sanitary wants of school-rooms, the causes and prevention of perils to health and life in places of public assemblage, and the means of increased safety in traveling by railways and steam-vessels, have come under the scrutiny of scientific investigators. The problems of sanitary engineering in public drainage, sewering, water-supplies, park-planting and the conservation of forests, the organization of abattoirs and market-places, the utilization of refuse materials, the practice and improved methods of disinfection and sanitary cleansing, and the prevention of disease are receiving studious attention. At the same time, the resources of hygiene in the protection of ports and ships have begun to be so applied as to leave the interests of commerce and civilization unvexed

by any needless restrictions of quarantine. The happiness and prosperity of communities have been so greatly promoted by these uses of sanitary science that, in all portions of our country, there is now an assured basis of effective organization of the public health service.

Burdens of human misfortune and pauperism, which the people now impatiently bear, are justly recognized as being largely the inevitable outcome of unhygienic circumstances which environ and debase the lives of the ignorant, the indolent, the poor, the vicious; and while sentiments of philanthropy are evoked by the woes of our fellow-beings, we cannot fail to mark that "much of the misery of mankind, admitting of removal, is due to untimely death and its shadow, sickness, another name for suffering and depressed, disordered vitality." Thus the death-rate not only has its dismal penumbra of impoverishing and crippling sickness and disease, but also its inevitable attendants,— misery and misfortune, — so incurable that the grave alone can give complete relief. The boon of health, the enhanced value and usefulness of individual lives, the enjoyment of high degrees of working ability, and all the advantages of bodily and mental vigor by the aids which sanitary knowledge affords, express more emphatically than diminished death-rates can, the real value of the fruits of hygiene. The measureless worth of well-sustained bodily and mental powers as a result of hygienic conditions in the daily life, the domicile, and the habits of individuals and families, has been eloquently set forth by Mr. Lewis, in one of the contributions to this volume, and by Dr. Flint in the discourse on relations of food to health. The intimate relationships which sanitary improvements throughout the nation, and the consequent vigorous, healthful endowments, — constitutional and biological, — of the families of the people, will ever sustain to the welfare of individuals, communities, and the republic, are steadily kept in view by the members of the American Public Health Association; and these ultimate results, in the nature of increased social welfare and exalted character and capacities of the people, have indicated the objective points in the plan and purposes of this body. The fields of sanitary inquiry and effort enlarge and become more prolific as they are cultivated; for in all that relates to public health and personal or domestic hygiene, the progressive increase and diffusion of the popular knowledge of physiology and the rules of health serve to facilitate the practical efficiency, and augment the usefulness of sanitary laws and regulations. It is a leading object of the Association to promote the growth and uses of this department of knowledge, and to this end the written contributions received at its meetings are given to the press. Whether the public health-service is directed to the hygienic protection required for homes and all public places, and to the removal of sources of malaria and injury to individual health, or to the broadest application of sanitary works in cities and states, or to the industries and education of the people, or to the national and international relations of hygienic researches and duties based upon a comprehensive knowledge of the history and causation of destructive diseases, the hope of saving, year by year, vast numbers of fellow-beings from untimely death, and from sickness and disease, and the evils they entail, is enough to animate and reward the efforts of every enlightened man who believes in human progress.

I.

GENERAL REQUIREMENTS OF HYGIENE.—APPLICATIONS OF LAW FOR PUBLIC HEALTH PURPOSES.

FOOD IN ITS RELATIONS TO PERSONAL AND PUBLIC HEALTH.

By AUSTIN FLINT, M. D., *New York.*

A DISCOURSE AT THE ANNUAL MEETING, BOSTON, OCTOBER 4, 1876.

THE subject assigned to me is so large that I must define, at the outset, the limitations of my discourse. I will do this by following what is known in medicine as the "Method of Exclusion." I shall not enter into any details of anatomy and physiology, although I shall have occasion to cite some well established physiological truths. I shall not raise any questions concerning the chemistry of food, that is, as resolvable into ultimate elements; nor shall I consider the proximate elements, or the different elementary principles, nitrogenized, and non-nitrogenized, in their respective relations to nutrition, respiration, and other functions of the body and mind. I shall not undertake to present any of the facts relating to the relative digestibility and the nutritive value of particular articles of food, which have been ascertained by the experiments of Beaumont, the observations made by means of artificial fistulæ in inferior animals, and the conclusions drawn from personal experience by those who have attempted to study the subject in these points of view. The changes produced by the different modes of preparing food, that is, by culinary processes, and the influence of the various accessories to alimentation will not be embraced in my discourse. Excluding all these classes of topics, what, it may be asked, remains? Enough, I answer, to occupy all the time which I can presume sufficiently upon the patience of my audience to claim. In general terms, the objects of my discourse will be, to vindicate the claims of my subject upon the interest of not only medical men, but the public; to do justice to nature, or, more correctly, Providence, as regards the instinctive provisions for alimentation, and to point out certain popular errors in relation to diet, affecting injuriously personal and public health. I do not, in short, propose to treat of the subject in any of those aspects which may be distinguished as scientific; but the positions which I shall take, while they are in harmony with

the facts of science, will have their basis in reason, experience, and common sense.

The necessity of food is, of course, recognized as a fixed fact. Every one knows that we must eat to live. To the statement of this fact is often added another statement, namely, we do not live to eat. Now I claim that we are not to eat merely to live. Alimentation has ends beyond simple existence. We must eat to secure the complete development and growth of all parts of the organism. Thereon depend the maturing and perfecting of all the functions, mental as well as vital. Eating is indispensable for attaining to the capabilities of body and mind. It is equally indispensable for maintaining these capabilities. In other words, health, in its broadest sense, psychical as well as physical, is dependent on food. We must eat, therefore, for something more than life. In a certain sense, we live to eat, inasmuch as thereby we may secure all the advantages of health. Alimentation is more than a necessity. It is important in proportion to the importance of fully developed bodily organs, with the functional capacity of each and all (the brain included) carried to the fullest extent.

With reference to the importance of food, let us look at the subject from physiology, as a stand-point, without going into physiological details. Alimentation is preliminary to the series of wonderful processes, by which the various principles embraced in food are converted into the different tissues and organic substances of the body. From the heterogeneous constituents of food is formed a liquid, — the blood,— definitely and uniformly constituted, containing organized, living bodies ; from this liquid is derived material for the growth and renewal of the solids, together with the secreted and excreted fluids ; the fixed temperature of the body, and the activity of all the functions being dependent on its presence everywhere in the organism. Were I to go into physiological details, it would be seen that all the various operations and actions, within the economy, embracing perception, will, thought, feelings, as well as the functions distinguished as vegetative, are dependent on alimentation. This is the first link of the chain on which hangs everything essential to life and health. Looking at the subject from this point of view, the importance of a sufficient quantity and variety of food is obvious enough ; and, in this aspect, the subject has, beyond its importance, a certain degree of dignity, which, as will be seen presently, is at variance with many popular ideas.

Extending somewhat further this consideration of the subject, the full scope of the meaning of the term health is to be taken into account. Health, in its broadest sense, means something more than the possession of organs apparently sound, and the absence of symptoms which denote the operation of morbific agencies in the system. In the common acceptation of the term, health has different grades, as expressed by such qualifications as perfect, good, indifferent, and even poor, bad, or miserable. One may be deficient in health who is not under the care of a physician, who does not take physic, and who is not conscious of being ill. Complete health is a state in which all the organs of the body are capable of the normal exercise of their functions to the fullest extent. Accepting this definition, there are very many

who, as regards physical functions, although not on the sick list, are unhealthy persons. But this definition takes in the mental faculties. Here opens up a range of thought of great interest, and having most important practical relations, to which I can only make a passing reference. The often quoted phrase, *mens sana in corpore sano*, is admitted to express a fact, but the importance of the fact, and its practical bearings, are very far from being generally appreciated. Not a small share of the ungraciousness, uncharitableness, moroseness, and ill nature pervading social and domestic life, are morbid manifestations. We may go much farther than this. The opinions and doctrines which underlie fanaticism, bigotry, and various eccentricities of conduct, and which so often conflict with a spirit of "Peace on earth, and good will toward man," may be the products of an abnormal working of the cerebral organs. Intemperance, with all its evils, in not a few instances, originates in physical disorders. Many crimes proceed, not from primary perversions of the mind, but from unhealthy conditions. Criminals are executed and imprisoned who are pathological victims, and therefore proper subjects for medical treatment rather than for legal penalties. I must not dwell on this topic. I will only add that for one who has youth, leisure, and the qualifications for a first-rate agitator, there is no better field for labor than that which embraces reforms in criminal laws, public opinion, and Christian philanthropy, based on an appreciation of health in the broadest sense of the term.

There is a consideration which renders alimentation especially important, namely, this alone, of all the physiological processes dependent upon it, is under direct voluntary control. Independently of influences exerted through alimentation, the processes of digestion, assimilation, nutrition, etc., can only be affected by means of medicinal agencies. The quantity, quality, and variety of food admit of being regulated at will, and, aside from medicinal agencies, the dependent processes can be reached directly in another way. This is not a proper occasion for introducing any questions in medicine; but I may state here an axiom which it is well for the public to understand, namely, physic or drugs can never be a substitute for food. Moreover our ability to affect digestion, assimilation, nutrition, etc., by medicinal agencies, is limited in comparison with the extent to which these processes may be affected through the agency of alimentation.

Thus far I have had reference to the claims of my subject upon public interest. The views presented show alimentation to be worthy of more distinction than that of a necessary condition of existence. Upon it depend the development of all parts of the organism, and the exercise of their fullest functional capabilities. It supports the chain of physiological processes on which the functions of the body and the capacities of the mind are dependent. It lies at the foundation of health, physical and mental. It is under direct voluntary control, and thereby we can most efficiently affect digestion, assimilation, nutrition, and other vital processes. From the fact last stated, it follows that there is a moral responsibility connected with food. So far from disparaging or undervaluing alimentation, then, we are bound to look upon it with great interest. It is our duty to eat for other

and higher purposes than merely to live. I proceed now to treat of the subject in its practical relations.

Life and health require a certain quantity of food daily. The quantity required by different persons varies within wide limits. It is a matter of common observation that there is nothing like uniformity in the amount of food which healthy persons need, and that the amount has no constant relation either to age, rapidity of growth, the bulk of the body, or habits of physical and mental activity. A child often consumes more food than many healthy persons of adult age. A youth growing rapidly may consume no more than one whose growth is slow. A man weighing two hundred pounds, or more, may be a small eater, while the "lean and hungry" not infrequently eat enormously. The indolent are often large eaters, while they who work actively their brains or muscles may be satisfied with a spare diet. The average quantity of food required for life and health, therefore, at any age and under precisely similar circumstances, so far as these are appreciable, cannot be a standard for any individual. The quantity required for a considerable number of persons, and the relative amount of each of the various alimentary principles, can be determined with accuracy, but the individual requirements cannot be in this way ascertained, any more than the duration of any individual life is determinable from mortuary statistics. These statistics show the average duration of life and what it is worth to insure the lives of a large number; but they would be useless as data for determining the probable duration of the life of any individual. It is practicable to construct, upon a physiological basis, diet tables for public institutions and armies; leaving but little waste, and providing amply for the alimentary requirements of all; but to prepare a diet table for one person, containing all that is required and no more, is impracticable. The ability to endure without great discomfort and injury the deprivation of food, is shown by observation to vary in different persons as widely as the daily requirement in respect of quantity. I shall not undertake to give the physiological explanation of these facts; it would not be an easy thing to do, were I to undertake it. Life and health require, as is well known, not only an adequate quantity of food, but a qualitative diet, that is, a diet containing in proper proportions the numerous alimentary principles. A diet deficient in any of the more important of these principles, no matter how abundant it may be, is incapable of sustaining life indefinitely; and deficiency of any of the less important principles is incompatible with health. There are those who are healthy, and have great physical or mental endurance, living on a diet astonishingly small, as compared with the average quantity of food which most persons consume, but it is essential that this small diet contain all the principles representing the elementary constituents of the body. Cream, lean meat, and wheaten bread, for example, although nutritious articles of diet, as every one knows, are singly not sufficient to meet the requirements of health, or even of life for a long period. One of the most striking of popular errors in regard to diet relates to milk — that precious form of food which has this superiority over other forms, namely, it embraces all the alimentary principles combined in exact relative pro-

portions by the hand of Providence. It is only within a few years that physicians have come to appreciate fully its preëminent value as the aliment for patients affected with acute diseases, and whenever solid food cannot be taken. There is, however, a widespread prejudice against its use for the sick. It is thought to increase fever, to occasion biliousness; and many declare they can never take it without inconvenience in health. This prejudice, which doubtless had its origin in past medical notions, is, at the present time, not an inconsiderable obstacle in the way of an adequate alimentation in disease.

A deprivation of aliment sufficient to cause death, we call starvation. This term may be conveniently used to denote different degrees of harm, from defective alimentation, falling short of death; and it may also be applied to innutrition limited to particular portions of the organism. There are those — and the number is not exceedingly small — who live long, but, as regards nutrition, always live a starved life. Such instances are found among persons not driven to starvation by poverty or other causes of necessity; but they are starved in consequence of erroneous sanitary ideas or false habits. It occurs to me as a physician, to meet with such instances not infrequently. Again, there are those who, as regards some parts of the body are starved, in consequence of a deficient supply of certain of the alimentary principles. These persons may have an abundance of fat and muscle, presenting in outward appearance the aspect of health. The weight of the body is no criterion in judging of the condition of certain of its components. Every physician knows that the average normal weight of the body may be preserved, although the blood itself may be starved, that is, so impoverished as to give rise to various nervous maladies. The so-called "training diet" may favor a great development of muscular substance and power, while the brain is deficiently nourished; in other words, more or less starved. Certain it is, that the bulk and strength of muscle do not carry with them growth and capacity of brain. If these assertions be facts, as I believe them to be, they commend themselves to the reflections of those who are advocates of the preëminence now given to athletic exercises in many of our colleges and schools.

I come now to the practical inquiry, how is alimentation, in respect of the quantity and kinds of food, to be regulated with reference to personal and public health? As has been seen, averages are of no value in this regard, owing to the wide range of variation among individuals in alimentary requirements. For the same reason, the requirements of any one person are of no value in determining those of other persons. A purely scientific method would be to collect and analyze all the egesta of each person for a certain length of time, and then, by exact weight, to combine different alimentary principles, to meet the requirements, as thus ascertained, for that person. This method would apply to the renewal of the constituents of the body, but not to the increase by growth; nor would it be applicable to the organism under other circumstances than those existing at the time of the analysis. Assuming this method to be feasible, it would require, in addition to a high degree of knowledge and skill, an immensity of labor

and care. Other objections might be raised; but the method is manifestly impracticable, and no one has ever proposed that different persons should resort to it for the regulation of diet. There are but two sources of practical knowledge which are available. One is in the instincts implanted in the organism for this express purpose; the other is in individual experience. Of these two sources, the first is the more trustworthy. Individual experience is open to fallacies, some of which I shall mention. To render "justice to nature, or more correctly, Providence, as regards the instinctive provisions of alimentation," is an object of my discourse on which I desire to lay special stress. I shall, therefore, enlarge on this topic.

The instinctive provisions for alimentation are inherent in hunger, appetite and taste. These physiological faculties have obviously alimentation as their final cause. In the inferior animals they suffice for the requirements of nutrition. In man, reason is brought to bear upon these as upon other faculties of the body; hence arises a capital distinction between man and inferior animals, namely, in the preparation of foods. Man selects, combines and modifies, in a great variety of ways, by culinary processes, articles of diet. Appetite and taste may be educated and variously affected by custom. This, however, is true of inferior animals, and shows the extent of adaptability in living bodies. It may certainly be assumed that Providence has not instituted hunger, appetite, and taste in order to have them repressed or antagonized. Normal instincts, having obvious reference to the needs and welfare of the organism, are entitled to precedence over human judgment. They are guides to be followed, — reason and experience providing and furnishing certain regulations for their exercise, but never contravening them. Let us make a practical application of these truisms. Hunger, as we know, in an extreme degree, absorbs every sentiment and enchains the will, so that the sufferer is not morally responsible for obtaining food by criminal means, or for cannibalism. Existing for a certain time, the morbid state which it denotes ends in death. If, after prolonged abstinence, the means of satisfying hunger be obtained, it has been found that the craving for food cannot be at once fully satisfied without risk. Here is an example of the regulation of this instinct by experience.

Appetite and hunger are different degrees of the same instinctive sense; but there is this difference between them: the one is physiological, the other pathological. The sense of hunger denotes an abnormal condition, whereas appetite is a normal expression of the need of alimentation. In addition to this significance, appetite has another, namely, the quantity of aliment needed. In these two purposes consist the instinctive provisions for the amount of food to be taken, and the times of taking it. The complete requirements of health are, that the desire for food be heeded without delay, and that this desire be fully satisfied. Do popular notions correspond to these requirements of health?

In my young days, in Massachusetts, it was often enjoined as a capital maxim in dietetics, that one should always rise from the table with a good appetite. We do not as often now-a-days, as then, hear this maxim quoted; but not a few still, in a measure, act upon it. I think it is not an uncommon

idea, that for the appetite never to be satisfied is conducive to health; persons sometimes express, with a feeling akin to remorse, regret that they have not resolution enough to put the idea in practice. And another idea, now, as then, is quite prevalent, namely, that food should never be taken except at certain fixed times, no matter how great may be a desire for it at other times. Exact regularity of meals, and an amount of food more or less under that indicated by the instinctive want of it, have been, and are considered good sanitary rules. They probably grew, in part, out of a medical doctrine, now obsolete, that most diseases arise from over eating. This doctrine had its fullest development in Abernethy's day, when the practice of medicine consisted largely in the administration of blue pills, followed by the "black draught."

A little book entitled "Health and Long Life," written by a Venetian nobleman, Lewis Cornaro, has had not an inconsiderable influence in popularizing the idea that great abstemiousness in diet contributes to the welfare of body and mind. Cornaro, at nearly forty years of age, broken down apparently by intemperate habits, adopted a meagre diet, eating, to quote his words, only food enough to keep body and soul together; and persevering in this plan, he lived to be over a hundred years old. His book consists of three discourses written at different periods in his old age, — the first at the age of eighty-three, and the last at the age of ninety-one, years. These discourses are characterized by the complacency and egotism of cheerful senility. They abound in rhapsodic laudation of not only the sanitary merits, but the beauty, loveliness, and even holiness of a life of dietetic abstinence. This work, published in Boston in 1814, has passed through thirty or more editions, and is still in circulation. Other centenarians, however, as regards diet, have been "good livers," for example, the celebrated Dr. Holyoke; and I could cite an instance which was under my own observation. The fact that Cornaro lived a century, is by no means proof that his system of diet had aught to do with his longevity. As well might it be assumed that Captain Lahrbush, the present centenarian of New York, who claims 109 years, owes his longevity to the use of opium to the extent of 80 grs. daily. In fact, it is said that Captain Lahrbush does consider this use of opium a cause of his longevity. The writer of an interesting article, entitled "The Curiosities of Longevity," in "Scribner's Magazine," mentions the instance of John Weeks, aged 114, who married his tenth wife, a girl of 16, at the age of 106, and who had "a voracious appetite, eating, only a few hours before death, three pounds of pork, two pounds of bread, and drinking a pint of wine." Another instance was the Rev. Mr. Davise, the vicar of Staunton-on-Wye, who died at the age of 105, and who, quoting the writer's words, "ate of hot rolls, well buttered, and drank plenty of tea and coffee for breakfast; at dinner, he consumed a variety of dishes; at supper, wine and hot roast meat were spread before him."[1] In view of the dietetic habits of other centenarians, it is probable that Cornaro's length of days is a striking instance of the duration of life in spite of a meagre diet, as we sometimes see an old tree tenacious of vitality in a soil from which, as it would seem,

[1] Number for November, 1875.

its roots could hardly derive sufficient nourishment. Moreover, Cornaro's old age was singularly free from circumstances involving wear and tear. But an extension of life beyond its natural limit is a far less important object than the maintenance of health and vigor during the allotted threescore years and ten.

Other than sanitary considerations have been, and are still, involved in the popular notions of which I am speaking. Not a few of those engaged in intellectual pursuits have been led to believe that a full diet tends to impair the faculties of the mind, and debase the finer sentiments of our nature. Mental deficiencies, grossness of inclinations, and a want of capacity to reach those exaltations distinguished as spiritual, as well as physical maladies, have been attributed to following the dictates of a normal appetite. Hence, a moral element has entered into dietetics. "Thank God I have never been a gormandizer," was an exclamation made to me by a patient a few days since, when urged to take nutritious food as the means of recuperation from disease. He had lived and labored on an insufficient diet. Had it not been for a reluctance to disturb the comfort which he seemed to derive from the idea that he had at least been dutiful in diet, I should have been tempted to reply, "Would that you had been what you call a gormandizer; your prospect of recovery might then have been better than it is."

Physiology, experience, and common sense, are alike opposed to these popular notions relating to food. Conditions for perfect health are, *first*, a sufficient appetite; *second*, the gratification of normal appetite before the want of food reaches the abnormal degree expressed by hunger; *third*, the satisfaction of appetite by an adequate quantity of food. These conditions of health are fulfilled by compliance with the instinctive provisions for alimentation.

But, it will be asked, is appetite infallible as a guide in dietetics? Following it as a guide, is food never taken beyond the requirements of health? I answer, It is a reliable guide under normal circumstances. The inevitable circumstances of life are often not altogether normal, although producing no distinct morbid affection. Experience teaches, for example, that in a state of fatigue or exhaustion (which is not a normal state), inconvenience may arise from the full gratification of appetite; that if unusual exertions, mental or physical, are to follow, a hearty meal may occasion disturbance — and other examples might be added. Irrespective of abnormal or disturbing influences, if appetite be not infallible, it is, at all events, more reliable than rules based on theoretical ideas, popular notions, or on purely physiological data. Moreover, it was evidently not intended that the quantity of food should be accurately adjusted to the needs of the economy. To do this is impossible, and, therefore, it is necessary to elect between the risk of taking either more or less food than is actually required. Which is to be preferred? Undoubtedly it is vastly better to incur the risk of taking too much than that of taking too little. Nature provides for a redundancy, but there is no provision against a persistent deficiency. *Ex nihilo nihil fit.* An ample supply of alimentary principles is indispensable to nutrition; and inasmuch as the supply cannot be made to contain precisely the needed amount of the

different alimentary principles, we may say that a superabundance of food is a requirement for health.

As in appetite we have a guide in respect of the times of taking food and the quantity to be taken, so taste is a guide in respect of the kinds of food required. The discrimination of food with reference to the wants of the system is the evident purpose of the sense of taste, and the enjoyment connected with this sense was designed to afford a security, in addition to appetite, for adequate alimentation. Appetite has been disparaged to the prejudice of personal and public health, but the gustatory sense has been treated still worse. It has, indeed, been shamefully treated by some would-be sanitarians, pseudo-moralists, and fanatics. Not only has the physiological purpose of gustation been ignored, but, although popular notions on this topic have undergone within the last half century considerable change, there are many at this day who look upon the enjoyment of gustation as at least bordering on sensuality and sin. It was consistent with errors concerning appetite, to which I have referred, to frown upon the idea that the pleasure of eating is innocent and salutary. Hence, coarse food and poor cooking have been thought to be conducive to health. The tables of many of our public houses, of educational establishments, and of well-to-do people in city and country (not to include water-cures, and other so-called health resorts) afford ample evidence that these notions by no means belong altogether to the past.

Reverting to its physiological relations, taste, under normal circumstances, is reliable for the discrimination of the kinds of food and the preparations of food best adapted to digestion and assimilation. If not infallible, it is designed for this purpose, and is more reliable than any other means of discrimination. Like appetite, it is to be regulated by lessons of experience. For instance, *bon-bons* are to many persons palatable, but experience would soon teach their unsuitableness as staple articles of diet. Physiology explains the importance of taste in alimentation by showing that gustatory satisfaction has a direct connection with the production of that wonderful secretion, the gastric juice, by which stomach-digestion is effected. The abundance of this digestive agent is, in a measure, dependent on pleasurable excitation of the gustatory sense. Here is a reason for the fact that, as a rule, the preparations of food which are most palatable, are most digestible. A fair experience corroborates this fact. May not taste be perverted, and indulgence in its pleasures be carried so far as to lead to over ingestion of food? Undoubtedly this, like other sources of enjoyment, psychical and physical, is liable to be abused. I have no wish to underrate its abuses. A simple rule, however, if followed, will prevent or correct these. If taste be subordinate to a normal appetite, it can hardly lead to perversion or over indulgence; but if it be cultivated or stimulated beyond the claims of appetite, in other words, if it be the master, instead of the servant, of appetite, its physiological purpose is exceeded, and indulgence is not in conformity with the laws of health. The simple rule is, not to allow the temptations incident to taste to lead beyond the satisfaction of a normal appetite.

My plea in behalf of gustation suggests a topic which may seem to some

too homely and trivial to introduce in a discourse before the "American Public Health Association." I refer to the functions of the cook. The popular notions derogatory to appetite and taste, of course, tend to disparage the functions of the cook. Good cooking is not an advantage if it be desirable to repress appetite and discourage gustatory enjoyment; and the estimation in which cooking is held by many in this country, fairly represents the prevalence of these popular notions. Bad cooking is the rule, good cooking the exception. The truly artistic cook — the veritable *cordon bleu* — is a rare bird with us. The calling of a man cook ranks a little above that of the waiter man; it is perhaps nearly up to that of a first-rate barber or hair-dresser. Almost invariably the professional male cook is an exotic production, — generally imported from France, — the calling being below the dignity of a native American not of African descent. A hired woman cook holds her head somewhat higher than the waitress and laundress, not so much on account of her superior rank, as from certain advantages of her position. The responsibility of cooking, however, in small households, either rests with a maid-of-all-work, or it is assumed by the mistress whose qualifications are derived from perhaps a little experience, the possession of some family receipts, and possibly a cook-book. I shall not linger on this topic, but leave it with a few assertions. If alimentation have the importance and dignity which I have claimed for it; if appetite and taste are to be estimated by their physiological relations, the functions of the cook are of a higher grade than that denoted by the facts just stated. A skillful cook, male or female, is entitled to as much distinction, at least, as a clever mechanic. The calling should be reckoned an honorable one. The science and the art of cooking should be taught by competent professors, and should be embraced in the curriculum of female schools. More than this, here is a field for discoveries, inventions, and continued progress. To devise new combinations and culinary processes, is a worthy object of study and experiment. He who may originate a new article of diet, palatable, digestible, and nutritious, by utilizing materials which are readily available, deserves something of the credit belonging to one who makes two blades of grass grow where but one grew before.

I shall devote the remainder of my discourse to some popular errors not already referred to. For the most part, my remarks will have reference to alimentation in its relations to disorders of digestion. I am not about to try your patience with a medical disquisition on dyspepsia; let me, however, define the scope of the term. All the functional disturbances of the digestive system are embraced under this name, whether they consist of merely discomfort or distress, referred to the digestive organs, together with symptoms referable elsewhere, inclusive of the mind, or of the varied manifestations of chemical changes taking place in consequence of these not being controlled by the processes of digestion. In other words, dyspeptic ailments proceed from either labored or imperfect digestion. Dyspeptic disorders are of interest in connection with alimentation in this, namely, the patient is cognizant of them; they are subjective; whereas, of disorders of the processes following digestion, the patient is unconscious, these being

manifested only in their remote effects. It is a significant fact, that dyspepsia is vastly less frequent now than a half century ago. It is hardly an exaggeration to say that in my early professional life in New England, a large majority of those who reflected, read, or listened to lectures on health, became dyspeptics. Generally, when persons casually met, after disposing of the weather, the conversation turned on the subject of dyspepsia and topics therewith connected, especially diet. The number of dyspeptics has diminished in proportion as the popular ideas to which I have already referred have undergone modification. Another significant fact is, dyspepsia, then and now, is in a great measure confined to the reflecting, reading, intellectual class, and more especially to those who have abundance of leisure. The "laboring classes," as they are termed, and those whose time and thoughts are so fully occupied by their pursuits as to leave but little opportunity for introversion, are rarely dyspeptics. These are facts which may be accounted for, as will presently appear.

It is a great popular error to suppose that the chief duty of man is to watch the processes of digestion, and try to determine, by means of personal sensations, what articles of diet agree and what disagree. Not a few persons fall into this error, and it is almost certain that they become dyspeptics. They fail to trust sufficiently in Nature or Providence, and ill health is the penalty. I will step beyond the limits of my subject so far as to add, that a dyspeptic, while pursuing this course, will never recover full health. A physician, nearly ninety years of age, who had led the irregular and laborious life of a country practitioner, always enjoying robust health, in answer to my inquiry, to what he attributed his longevity and vigor, replied, "I know of no other reason than this: I have always eaten when I wanted to eat, and as much as I wanted, and the best I could get."

But, I can imagine I hear it said, are you not making a plea for gluttony? As between excess and deficiency in eating, I admit it. Of the two evils, gluttony is the least. But the term gourmand or glutton has not the same application with different minds. In the mind of the careful eater, who keeps his stomach under constant *surveillance*, and who is generally a dyspeptic, on that account, one who, without any care in diet, indulges fully a normal appetite, is a glutton. Let us contrast the two. Your careless feeder satisfies his appetite without stint or hesitation, having an instinctive reliance on his digestive powers. He may not be fastidious in the choice of food. He does not care to combine æsthetics with dietetics. After satisfying his appetite, until it is renewed, he gives to alimentation no thought. On the other hand, your careful eater is doubtful and anxious as to what it will be prudent for him to eat, having no confidence in his stomach. He is suspicious of this or that article of food, and if he venture to make trial of it, he does so with misgivings. His *menu* is limited, because he fancies that more or less of wholesome articles of diet do not agree with him. Eating without satiety, and with little, if any, gustatory enjoyment, his thoughts for the next few hours are engrossed with his digestion. It is a part of the serious business of his life to observe the sensations following the ingestion of food, in order to try to learn from experience how to avoid or mitigate dyspepsia.

Now, of these two typical persons, there can be no question as to which derives from alimentation health and vigor. But, aside from sanitary considerations, compare the two as regards the time and thought deducted from higher objects, — the duties of life or its rational enjoyments, — and devoted not only needlessly, but injuriously, to the bodily functions. In this point of view, if the former be a glutton, the contrast renders gluttony desirable and praiseworthy.

There is another and quite a different variety of a careful eater, the fastidious eater, the *connoisseur* in eating, one who studies the natural affinities of viands, the proper succession of courses, and the various appliances for heightening the gratification of gustation; the gastronomist, the æsthetic eater, who combines beauty to the eye, with the enjoyment of the taste; the eater for whom the *cuisine* is a laboratory for the exercise of science and art. That the cultivation and indulgence of the pleasures of the table do harm by making appetite subordinate to taste, I need not say. Eaters of this class, however, are not always gluttons; and, with proper limitations, scientific, artistic eating is conducive to health. It is to be added that culinary science and art need not be the prerogative of wealth. The average farmer, clerk, mechanic, or any one with moderate means, could command their advantages if blessed with a helpmeet having a fair amount of practical knowledge which, with proper opportunities, might be easily acquired. While writing this discourse I have seen a newspaper statement that an "eccentric millionaire" in Massachusetts had given a farm, together with a large sum of money, to found a school for education in cooking.[1] Whether he was called eccentric on account of the novelty of an endowment for such an object, I cannot say; but this practical direction of munificent philanthrophy shows an intelligence looking from above prevalent popular errors on the subject of dietetics.

It is an error to suppose that one can judge with accuracy from personal sensations of the effects of different articles of food. Experience thus obtained is often fallacious. The functions of digestion are liable to be disturbed by many causes, intrinsic and extrinsic, irrespective of diet; the disturbances are then apt to be attributed erroneously to particular articles which happened to have been eaten. The expectation that certain kinds of food will disagree is sufficient often to occasion disturbance. Nothing is more common than to hear persons say that milk and eggs never agree with *them*. These are the two types of a complete aliment, that is an aliment combining all the alimentary principles required for nutrition. It is safe to say of the notion that there are some healthy stomachs which cannot digest these articles of food, if not purely a theoretical notion, or a whim, it is derived from fallacious experience.

An exaggeration of the fact of individual idiosyncrasies is a common error. The idea of innate peculiarities of the physical constitution is a not uncommon form of egotism. It is sometimes curiously manifested in regard to medicines. A man or a woman, robust and perhaps weighing two hundred pounds or more, not infrequently imagines that, owing to a singu-

[1] The name of the giver is William Emmerson Baker.

larly susceptible organism, drugs must be prescribed in infinitesimal doses. It is often said by patients to physicians, "You must give *me* remedies in the doses which you would prescribe for an infant." There is something congenial to self-love in the thought that one is not altogether constituted like other people; it is a congenital mark of distinction. The experienced physician, when this is said to him, fully understands it, although he may have tact enough not to enter into any discussion of the matter; and if the indications be urgent, he prescribes from his own convictions, and not in accordance with the notions of the patient. As with medicines, so with diet, the greater part of supposed idiosyncrasies exist only in imagination. Here, however, the physician cannot exercise his own judgment as in prescribing drugs; he must, if he deem it of sufficient importance, either place his opinion in opposition to that of the patient, or try to overcome the error by argument. He is under a disadvantage whichever course he pursues. That there are idiosyncrasies in respect of both medicines and diet is not to be denied. It would be easy to cite illustrations. But they are vastly less frequent than is generally supposed. There is little foundation for the proverb, "What is one man's meat is another man's poison." As a rule, whatever is wholesome for one, is wholesome for all.

A conclusion from the error just noticed is, that to judge of others by one's own dietetic peculiarities, either fancied or real, is erroneous. This, however, is often done. Physicians are open to criticism on this score. A medical man believes that certain articles of diet disagree, or are not, in his personal experience, healthful. Whereupon he enjoins their disuse upon his patients and friends. If a medical writer, he may give to his belief the weight of his authority through the press. In this way not a few varieties of food have fallen under an unjust popular prejudice. Probably the idea that pastry is to be denounced as unhealthy, and the abhorrence with which the wholesome cucumber is looked upon by many, may be thus accounted for.

Another error is the supposition that the functional ability of the digestive organs is maintained in proportion as they have little work to do. Physiology and experience teach otherwise. It is a law of the living organism that deficiency of functional exercise impairs function; and that prolonged suspension of function leads to organic changes which destroy functional capacity. As regards the voluntary muscles, this law is sufficiently familiar. Muscles but little used become attenuated and weak; if not at all used, they undergo atrophic and degenerative changes by which their power of contraction is lost. The same is true of the mental faculties; an adequate exercise of these is essential to their preservation. This law applies to the digestive as well as to all other organs. If the gastric and other glands secreting the fluids on which digestion depends be insufficiently excited to activity from an insufficient alimentation, their secretory capability is diminished, and the digestive power proportionably lessened. Protracted abstinence or the deprivation of food may induce irremediable degenerative changes in these glands. A condition for the maintenance of the normal capacity of all the organs of the body, is the exercise, within normal limits, of their respective

functions. This fact is not less true in its application to the digestive system than to other parts of the organism.

A practical error akin to the preceding, is to allow long intervals between the times of taking food, under the idea that thereby the digestive organs are better enabled to recover their functional energy than when the intervals are short. Some physicians have held this idea. Fordyce was accustomed to eat but once in the twenty-four hours, his single meal being enormous. This practice has been adopted by some religious orders. It is a physiological error, the fact being that, after a certain interval, the organs are weakened by inactivity. Habit has much influence over the digestive, or over other functions, but, as a rule, from four to six hours only, in the day time, should intervene between the times of taking food. The interval during the sleeping hours is, usually at least, doubled, so that the appetite should be good when fast is broken in the morning, that is, at breakfast, and a good appetite for this meal is one of the criteria of health. Some medical writer has said of the stomach: "It is like the school-boy; if not kept well occupied, it is apt to be in mischief." The healthy condition of all the organs of the body (and also those of the mind) is best maintained by the exercise of their functions, if not abnormally excited or overtasked.

Finally; all theories or hypotheses which are in antagonism to the instinctive provisions for alimentation must lead to practical errors. It is an error to live upon vegetable food alone, or exclusively on animal food. It is an error to restrict the ingestion of fluids when the need of them is expressed by thirst, as has been sometimes inculcated by physicians under the idea that the digestive fluids are liable thereby to be too much diluted. Many years ago, a medical writer in Massachusetts advocated living altogether without drink, compelling the system to derive all the liquid it requires from fruit and succulent vegetables largely added to other articles of diet. He abstained from drink for a series of months in order to demonstrate that it was not essential to life and health. I have never heard, however, of any one else having tried this experiment. Confining one's self to a few articles of diet, and uniformly to the same articles, although these may be highly nutritious, is an error, taste and appetite and digestion claiming variety in diet. I do not wish to be understood as saying that these and other kindred popular errors are always destructive to life or incompatible with fair health. Life and fair health may be maintained under considerable difficulties and disadvantages connected with alimentation. It would be easy to cite instances of individuals and tribes living exclusively on vegetable food, or on meat, eating only after long intervals, and confined to a few kinds of either vegetable or animal food. But for the maintenance of the fullest development of all parts of the organism, with their maximum of functional capabilities, in other words, the highest attainable point of health, these errors are to be avoided.

My subject, as I stated at the outset, is a large one. I have done very imperfect justice to the topics embraced within the limitations of my discourse. I shall be satisfied if, by what I have said, I shall excite interest in the subject, and do something toward securing in the minds

of the medical profession and the public a fuller recognition of its importance. It is important in the various aspects to which I referred briefly at the beginning of my discourse. Its importance has relations to all periods of life. The life of the infant deprived of the nourishment which is its birthright, depends on a proper substitute. I make this reference in order to warn parents not to accept for infantile life any article of food other than milk. Do not be led astray even by the name of Liebig, nor by the recommendations of personages be they never so distinguished. There are few topics relating to alimentation of greater practical importance than protection against the dilution and adulteration of milk. In 1873 Professor James F. Babcock, found that in the city of Boston, out of twelve samples analyzed, ten were more or less diluted: six were adulterated with caramel, four with salt, one with bicarbonate of soda and one with brown sugar. These samples were all obtained "from most respectable milkmen or grocers, and were all sold as pure and at the highest price."[1] There are sufficient grounds for the belief that even in the city of New York similar frauds, which are destructive of infantile life by starvation, if not by poisoning, are practiced! Do not fall into the error of thinking that cream is the nutritive essence of milk; it is the fatty constituent only, and is insufficient for nutrition, the more valuable constituents being in skimmed milk.

The subject is of great importance in relation to childhood and youth. The instances are not few in which the physical and mental powers are stunted by insufficient alimentation, proceeding sometimes (although rarely in this country) from poverty, sometimes from neglect, but much oftener from over caution and the prevalence of popular errors. Growing boys at school may be underfed, or the food be so unpalatable that the system suffers from an insufficient supply of the different alimentary principles. Girls are apt to be impressed with the idea that to eat heartily is gross and unrefined, as well as injurious to health and beauty; hence, they eschew the wholesome, substantial articles of diet. The majority of school girls are anæmic, suffering more or less from the ailments incident to impoverished blood. They grow into womanhood with feeble bodies (to say nothing of the mind), and are expected to become mothers of stalwart men.

In these relations, the subject touches the sources of public health; more than this, it touches the question of either the progress of our people in mental and physical vigor, or, on the other hand, degeneracy of mind and body. I cannot follow the subject into these relations, but the importance derived therefrom has, as I trust, been rendered somewhat apparent by the views which I have presented in this discourse.

If, at least, I have not succeeded in rendering evident the interest and importance of food in its relations to personal and public health, the fault lies, not in the subject, but in the discourse.

[1] *Fourth Annual Report of the State Board of Health of Massachusetts.*

SANITARY REGULATIONS RELATING TO ABATTOIRS.

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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 3, 1876.

Private slaughter-houses are the sources of foul odors detrimental to the public health : —
(*a.*) The business is conducted in a rude, disgusting, and wasteful manner.
Recent laws and improvements : —
(*a.*) Wholesome laws compelling suitable concentration of the business, and the supervision and inspection of abattoirs by sanitary authorities a necessity.
(*b.*) Under such laws and supervision, the business may be carried on without offense, and with profitable results to those engaged in it.

The business of slaughtering is a very filthy one at best. From remote ages until the present day it has been carried on in private slaughter-houses in the most unskillful and disgusting manner. Frequently, in populous places, the slaughterers are avaricious men, who conduct their business with the least possibly outlay for buildings or other appurtenances, and in total disregard of the health or the comfort of the public. Immature calves and other animals whose flesh is unfit for human food are killed, and even those that have died from disease or by accident are dressed, and the meat while fresh, or after being corned or manufactured into sausages, is offered for sale in the open market.

Many of the buildings in which the business is carried on are mere sheds or out-houses, wherein no attempt has been made to fit them for the purpose; consequently the floors and other wood-work soon become saturated with blood and bespattered with filth.

Moreover, the disposition of the offal and refuse material is necessarily attended with more or less offense. They are often suffered to remain in or about the buildings until decomposition takes place, when they are collected by different parties, one taking the hides, another the fat, another the bones, another the feet, etc., to be transported in different directions through the public streets, polluting the air with their noxious effluvia, until they reach their several destinations. Here the fat, bones, and other refuse are placed in open kettles or retorts and subjected to heat, which liberates the remaining noisome gases, to the discomfort and disgust of all who live in the vicinity.

A still more objectionable method is not unfrequently adopted. The intestines of the slaughtered animals, with other decomposing animal matter, are thrown into the piggeries, usually found connected with these slaughter-houses, to be eaten by the hogs, or wallowed in, and exposed to the sun; thus becoming the putrid source of the foulest odors, which poison the atmosphere for a great distance from the premises. The hogs fed upon

this disgusting material, so fruitful of trichinæ, are slaughtered in the adjoining shed, and the meat sent out to spread disease wherever it is eaten.

The drainage of these slaughter-houses, if there be any, is defective; allowing the animal liquids and bloody water filtering through the floors, to soak into the soil or to stagnate upon the surface. The cruelty sometimes exercised by the butchers towards the animals, before and while being slaughtered, is heart-sickening, and has in this State called for the interference of the Society for the Prevention of Cruelty to Animals.

The following vivid description of the condition of the animals, as they are herded in pens previous to being slaughtered, is by the late Dr. Edward B. Dalton, of New York.

He states that "they are herded in small, ill-ventilated pens, in many cases so crowded as to entirely prevent the cattle from moving about, where they are kept without food, barely long enough for the fever produced by the journey to subside, when they are killed, and at once distributed to consumers. While the cattle are thus penned up, they are the source not only of the greatest discomfort, but of great injury to the health of the community. The constant bellowing of the foot-sore and homesick cattle, the ceaseless moaning and bleating of calves and sheep, and the squealing and grunting of pigs disturb, and, indeed, oftentimes entirely destroy, the sleep of the occupants of the surrounding tenements, which are generally filled with the laboring classes, who can ill afford to be thus robbed of their natural rest.

"The emanations from the animals themselves, thus kept in unhealthy condition, and from their excretions, keep the atmosphere constantly tainted, while the hordes of rats, flies, and vermin which they attract render a residence in their vicinity, especially in hot weather, almost intolerable."

This description will apply to most, if not all, private slaughter-houses. However cleanly such places in themselves may be kept, with such surroundings it is not possible that they should be other than sources of offense, and dangerous to the health of the public.

It is only by a personal inspection of these establishments that any one can fully realize their perfectly disgusting character, and the slovenly and wasteful manner in which the business is conducted. A large portion of the blood and other refuse matter which, under the abattoir system, is utilized and made a source of profit, in these places is suffered to run to waste. During the year 1869, 53,000 beeves, 342,000 sheep, and 144,000 hogs were slaughtered within six miles of this very hall, producing 3,763 tons of offal, and 417,000 gallons of blood, a very large portion of which was thrown aside as worthless except as food for hogs. In order, therefore, to make the business a profitable one, these slaughterers are forced to purchase animals of an inferior quality, and sell the meat at a price far in excess of its real value.

Such has been the condition of private slaughter-houses from time immemorial. With the exception of the old Mosaic law, which prohibited the Jews from eating the flesh of any unclean beast, or that of any clean beast, unless it was slaughtered in a peculiar manner by one of their own race ap-

pointed for the purpose (which law is still enforced by the Jewish Rabbi), there does not appear to have been any restriction upon the trade until the time of the Roman emperors. At first the slaughter-houses in the city of Rome were scattered throughout its various sections, but were finally concentrated in one quarter and formed the public meat-market. This market, in the time of Nero, was one of the most imposing structures in the Roman capital. Several coins of that era which bear a delineation of this ancient edifice are still preserved, and give some idea of its magnificence.

As early as 1567 the attention of the French authorities was directed to the subject, but no definite action was taken to regulate the business until the time of Napoleon I., who originated the abattoir. In 1810 a decree was issued for the erection of public abattoirs in the outskirts of Paris. They were nearly completed before the fall of the Empire, but it was not until 1818 that the Parisian butchers ceased to slaughter in their private establishments. From that time to the present the business has been confined to the abattoirs. In 1867, the grand abattoirs "La Villette" were opened, and at these, most, if not all, the business of slaughtering for the city of Paris is now done.

In many of the cities of the continent, particularly in Vienna, the business is confined to abattoirs, where it is under the strictest supervision. Glasgow and Edinburgh have adopted the abattoir system with the most satisfactory results. In none of these places, however, has the rendering of the refuse material been confined exclusively to the abattoirs.

Not until 1844, when public opinion forced Parliament to interfere, was any action taken by the British Government to reform the abominable system which then prevailed; and then, owing to the large vested interest in the business, it was allowed to continue, under certain restrictions, for a period of thirty years. In 1852 Smithfield Market, one of the largest in London, situated in a very populous part of the city, became such an offense to the neighborhood that Parliament was obliged to interfere, and it was closed. A substitute for this market was provided at Islington. The first stone was laid in 1854, and it was opened on the 15th of June, 1855, by Prince Albert. It covers an area of some twenty acres, and is one of the best of its kind; yet it will not bear a favorable comparison with the abattoir "La Villette." In 1874 the Metropolis Building Act of 1844 should have taken effect. It prohibited the slaughter of animals in London except under special conditions with which it would have been almost impossible for the butchers to comply, and would have closed 1,500 slaughter-houses in that city. Parliament, however, instead of suppressing them, allowed those who were in the business to continue, and only prohibited the erection or opening of any new establishments. And now, notwithstanding the strict laws and rigid inspection to which they are subjected, the slaughter-houses of London are a discredit to that capital.

In this country we have been slow to join in the march of improvement in this direction. While many of the States have enacted the most stringent laws for the regulation of slaughtering, but little, if any, attempt has been made to enforce them, except in a few of our larger cities.

In the city of New York, previous to 1866, the slaughter-houses were scattered throughout the thickly settled portions of the city, from one extreme to the other. The following year the Board of Health, finding it impossible to supervise the business and keep it under proper control while it was so scattered, issued an order forbidding the driving or slaughtering of cattle below Fortieth Street. The slaughterers appealed to the courts for an injunction against the Board, which was granted, and the business was resumed. The question was then carried to the Court of Appeals, which reversed the decision of the lower courts, and the action of the Board was sustained. Since that time the number of slaughter-houses in the thickly-settled portions of the city has been constantly decreasing, and the business is being gradually concentrated in the large establishments or abattoirs. The Board of Health of New York, in their report for the year 1867, state "That a year ago it was argued, with some reason, that the sudden expulsion of slaughter-houses from the city would so embarrass the business as to seriously interfere with the supply of meat. Now, however, this is no longer the case. Extensive and thoroughly appointed abattoirs are now in operation in the immediate vicinity of the city, and in localities convenient to the public markets, of sufficient number and size to supply meat, fully and promptly, to the cities of New York and Brooklyn, even if all the private slaughter-houses should be closed to-morrow. These abattoirs are supplied with every facility not only for slaughtering animals, but for utilizing at once, within the same enclosure, all the refuse material while it is still fresh and inoffensive. A far less important, but still gratifying fact is, that experience of the past few months has proven that, by the use of abattoirs, cattle can be slaughtered and the meat dressed and delivered at the public markets or elsewhere, not only in far better and more wholesome condition, but at a decidedly less rate of expense than by the present system."

The Commonwealth of Massachusetts has not been indifferent to the necessity of regulating a business so prolific of danger to the public health. I find that on the 25th of October, 1692, the Great and General Court of Massachusetts Bay passed an Act, "That the selectmen of the towns of Boston, Salem, and Charlestown, respectively, or other market towns in the province, with two or more justices of the peace dwelling in the town, or two of the next justices in the county, shall, on or before the last day of March, 1693, assign some certain places in each of said towns (where it may be least offensive), for the erecting or setting up of slaughter-houses for the killing of all meat, still-houses and houses for trying of tallow and currying of leather (which houses may be erected of timber, the law referring to building of brick or stone notwithstanding); and shall cause an entry to be made in the town books of what places shall be by them so assigned, and to make known the same by posting it up in some public places of the town; at which houses and places respectively, and no other, all butchers and slaughterers, distillers, chandlers and curriers shall exercise and practice their respective trades and mysteries; on pain that any butcher or slaughterer transgressing this act by killing of meat in any other

place, for every conviction thereof before any one or more justices of the peace, shall forfeit and pay the sum of twenty shillings; and any distiller, chandler, or currier offending against this act, for every conviction thereof before their majesties' justices at the general sessions of the peace of the county, shall forfeit and pay the sum of five pounds; one-third part for the support of the government and the incident charges thereof, one-third to the poor of the town where such offense is committed, and one-third to him or them that shall inform and sue for the same."

In 1696 this act was amended, requiring those distillers and tallow-chandlers who might be convicted of carrying on their business contrary to the act, not only to pay the fine imposed, but also to enter into recognizance to take down their stills, coppers, or furnaces, and in default thereof to be committed to prison until he or they do cause the same to be taken down.

In 1710 the act was still further amended, as follows: "That when and so often, from time to time, as it shall appear any house or place assigned, or to be assigned, to and for the aforesaid trades or mysteries, has become a nuisance by reason of offensive and ill stenches proceeding from the same, or otherwise hurtful to the neighborhood, it shall and may be lawful to and for the Court of General Sessions of the Peace within the county, to cause inquiry to be made thereinto by a jury, and to suppress such nuisances by prohibiting and restraining the further use thereof for the exercise of either of the aforesaid trades or mysteries, under a fine of forty shillings per month, to be to the use of the poor of the town or otherwise, as in their discretion they shall think fit. . . . . That the proof of any dead beast or beasts hanging up in any outhouse, or the lying or carrying the entrails or garbage of beasts, or blood of creatures, in or out of such house, shall be sufficient conviction in law that such house is used for a slaughter-house, within the intent of the law against common nuisances."

These early and praiseworthy endeavors to regulate the business of slaughtering, and to control it in the interest of the public welfare, did not transmit to our more recent times their fullest beneficial effect. The business of butchering is prone to backslide, and Massachusetts butchers have illustrated the rule and not the exception.

The slaughter-houses and piggeries of Brighton for many years were a reproach to our good name for general cleanliness. At length, after years of persistent labor on the part of the State Board of Health, aided of late by the Board of Health of the City of Boston, on the 30th of November, 1875, by order of the City Board, all the private slaughter-houses within the limits of the city, with one or two unobjectionable exceptions in a remote district, were closed. Acting on the recommendation of the State Board, the Legislature of 1876 passed an act prohibiting, on and after the first day of June last, the business of slaughtering within the limits of the city, except at the abattoir in Brighton. This abattoir was incorporated in 1870, but did not commence operations until 1873. The grounds, which cover an area of about fifty acres, are located on the bank of Charles River, about four miles from the centre of the city, in a sparsely settled district, away from the public street, yet conveniently near the railroads and cattle

markets. It is constructed upon the most approved scientific principles, and is under careful and constant supervision.

The central building, called the rendering-house, is 200 feet by 80, and four stories high, on the sides of which are the slaughter-houses, with the necessary cattle-sheds, yards, stables, tripe-works, engine and boiler-house, etc. The beef slaughter-houses each cover a space thirty-eight feet wide by thirty feet long, or 1,140 square feet. Out of this space a room twenty feet square is taken, with double walls (two feet thick) packed with fine shavings, for a "cool-room," in which the meat is hung for several days before being sent to market. The temperature is maintained in warm weather by the cold air from an ice-box of fifteen to twenty tons' capacity built over the "cool-room" and connected with it. The circulation of air between the "cool-room" and the ice-box is regulated by means of valves in the air-ducts. The remaining space, fifteen feet wide, is used for slaughtering the cattle. The floor is of double plank, calked water-tight, like the deck of a ship, and laid upon iron beams with a slope to an iron gutter which catches the blood and conveys it below. There are several trap-doors in this floor, through which the hides, offal, etc., are dropped into separate iron tanks on wheels in the basement. The slaughtering-place opens to the rear upon the close-pen, the cattle-yards and sheds; and in front is the loading-shed, where the meat is put into the wagons. The "cool-rooms" are twelve feet six inches high. The slaughtering-places have the whole height of the building up into the roof, and are lighted by windows above the roofs of the sheds. By means of pulleys and shafting from the rendering-house, the cattle are hoisted for dressing, and the ice is lifted to the ice-chambers. Hot and cold water are supplied to each slaughter-house.

The basement story under the slaughter-houses is of brick walls, with a concrete floor, and has ample drainage. It extends, without partition, three hundred and eighty feet, from one end of the block to the other. In this story, under the trap-doors, are the iron tanks (on wheels) to receive the hides, heads, feet, tallow, tripe, blood, and offal. When filled, the tanks are wheeled into the rendering-house and their contents distributed, — the hides being left in the basement, and the blood and offal taken to the rendering-tanks and dryers by means of elevators.

The sheep slaughter-houses are similarly arranged, with "cool-room," slaughtering-place, etc., etc.

The rendering-house, which forms the centre of the whole group of the abattoir, is 200 feet by 80 feet, and four stories high, including a brick basement, which has a concrete floor like the basement of the slaughter-houses. The rendering-tanks are in the third story, suspended from the fourth floor. These tanks open at the top, on the level of the floor of the fourth story, where the offal is emptied into them from the small "tanks on wheels," coming from the slaughter-houses.

The dryers are in the second story, with openings in the floor above, near the rendering-tanks.

The boiler and engine house, of brick, stands quite near the rendering-house, and around the central smoke-flue are constructed four large flues or shafts for ventilating the various rooms of the rendering-house.

The animals slaughtered at this abattoir are mostly received by railroad from the West. On their arrival they are taken into the cattle-yards, thence they are led to the slaughter-houses, knocked down, and bled. The blood is drained into a receptacle below. The hides, heads, feet, tallow, and offal are dropped through their respective openings in the floor into iron carriages, in which they are removed to the rendering-house and distributed. The hides are taken to the basement to be salted, or sent to the tanneries in the neighboring towns. The blood, tallow, heads, feet, and other refuse, are taken to the rendering-house and placed in their several tanks or retorts, which, when filled, are firmly closed. Steam is then turned into the tanks, to the full pressure of the boilers. When the whole mass has been thoroughly steamed, the grease is drawn off at the side of the tanks, after which the contents or scraps are dropped through an opening in the bottom of the tank into large iron wagons and taken to the presses. After being pressed, it is passed into dryers below. From the dryers it is taken into the lofts, where it is cooled, packed, and sold for fertilizing purposes. The blood and heads of the animals are treated in much the same manner as the other refuse, except that they are put directly into the dryers without being pressed, the steam having coagulated the blood and reduced the bones to a pulp. The tallow is rendered in a tank by itself; when rendered it is pumped into coolers, from which it is drawn into casks ready for shipment. The feet and shin-bones are treated somewhat differently. They are skinned in the basement of the slaughter-houses, then taken to the rendering-house and steamed for twenty minutes, after which the hoofs are taken off and placed in a tank, when the neats-foot oil is extracted; when this is accomplished, and the shin-bones are thoroughly washed, they are removed to the attic to dry. The smaller bones, belonging to the feet, are taken to the fertilizing tank to be rendered with the other offal. The principal part of the tallow and all of the shin-bones and hoofs are sold to be shipped to Europe. The noxious gases are intercepted while passing from the different tanks and dryers, when in operation, at a point conveniently arranged where condensation takes place, and where they are separated from the steam. They are then discharged by means of a fan-blower, and forced under and through the fires of the boiler furnaces, which effectually destroy all offensive odors. After this purification they are discharged into the air through a chimney one hundred and sixty feet in height. This most important part of the process requires constant watchfulness and careful manipulation to avoid the escape of offensive odors.

Thus, within twenty-four hours after the animal is slaughtered, every part is either rendered or otherwise disposed of in such a manner as to be free from offense.

The act of incorporation of this abattoir provided that the plans, with all the details of construction of the buildings, should be submitted to and approved by the State Board of Health, and the business carried on under the supervision and in accordance with such regulations as said Board should, from time to time, establish. It was further provided that, for each violation of any regulation so made, the corporation should be liable to a fine of

not less than twenty nor more than five hundred dollars, to be recovered by indictment against said corporation. The act was amended the present year (1876), and the supervision of the abattoir was transferred to the Board of Health of the city of Boston, who were authorized to make whatever regulations may seem to them fit, in order to prevent the slaughter and sale of animals unfit for human food, and were empowered to appoint one or more inspectors to see that the rules and regulations of the Board were fully obeyed, and that none but healthy animals were slaughtered.

To protect the public still further against the liability of purchasing or eating diseased or unwholesome meat, the same Legislature passed an act, authorizing the mayor and aldermen of cities and the selectmen of towns to appoint one or more inspectors of animals intended for slaughter.

These inspectors were empowered to enter into all buildings or enclosures where such animals are kept, and to seize and destroy, or otherwise dispose of, all such as are unfit for human food.

Let the business be concentrated in one locality, where suitable buildings and appliances have been prepared for the slaughter of animals and the disposition of their refuse. Let there be a strict enforcement of laws like the foregoing, together with a constant and careful supervision by the health officers, and a rigid inspection of the animals intended for slaughter. There will then be no reason why the business may not be carried on at a convenient distance from the centre of any city without annoyance or detriment to the public health, and even with more profitable results than under the old system ; and the problem, " How can the nuisance created by the ordinary slaughter-house be most effectually abated? " will be satisfactorily answered.

SANITARY VIEW OF ABATTOIRS AND THE SLAUGHTERING BUSINESS IN NEW YORK.

By E. H. JANES, M. D.,
Assistant Sanitary Superintendent, New York.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 3, 1876.

Location, facilities, and sanitary condition of the abattoirs and of the smaller butcheries in the city.

Do. of those just beyond the city limits.

Nature and amount of sanitary inspection and supervision of the butchering business in the city.

Evils which continue notwithstanding all this and the stringent sanitary ordinances under the existing distributed system of small butcheries; degree of sanitary perfection obtained in the abattoirs.

Concentration of the business into a few abattoirs, under complete sanitary regulations acknowledged to be necessary for the public health and economy.

The transition of the methods of conducting this business is being brought about by the steady maintenance of sanitary requirements, and by the concessions of persons whose capital conducts it, as they find that the waste and nuisances of their business are sources also of detriment and loss in it.

Conclusion, and a Resolution for the consideration of the Association.

In this part of the discussion of the abattoir question it is proposed to give some account of the slaughtering business and of the present condition of abattoirs and the smaller butcheries within the boundaries of the writer's own field of sanitary labor, the city of New York; to point out the progress thus far made in the efforts at concentration of the business in that city, and the still further improvement which is already hailed as in the immediate future. I might premise, however, with the remark that the work of furnishing animal food to a population like that of the city of New York, is, to say the least of it, an undertaking which ranks high among the business enterprises of the country; one which requires large investment of capital, involves a variety of interests, and calls into action intelligence and business talents of no mean capacity. To satisfy the wants of a community consisting of more than one million of people, to contribute towards supplying the suburban and more distant towns and cities with animal food, and to provide for the exporting interests, which are constantly increasing in magnitude and importance, are duties which devolve upon the New York butchers; while the health authorities are charged with the important trust of seeing that this immense business is conducted in such a manner as to be least prejudicial to the public health; that the vast amount of refuse and offal produced be so disposed of as not to become a perpetual, public nuisance; and that the many offensive trades growing out of the slaughtering business, and either directly or indirectly connected with it, be placed and maintained

under the proper sanitary direction and control. It is alike for the interests of trade, and for the interests of public health and of public comfort, that the local sanitary authorities so regulate and control the slaughtering business, as to secure to those engaged in it the greatest economy, and at the same time to protect the public from the many nuisances emanating from it. We must also admit, that when radical changes are to be effected in so large and useful an industry, the entire question should be carefully considered and extreme measures adopted only after mature study and deliberation, and with as much consideration for the affected parties as is consistent with the public health and the public welfare. Such has been the policy of the New York Board of Health in dealing with this question, and by making haste slowly, yet by constant and persistent pressure, considerable advance has been made towards concentration, and still further results are on the eve of completion. That we may have some idea of the extent to which the slaughtering business is carried on in New York, let us glance at the approximate figures as obtained from the butchers themselves, and which sum up as follows: The number of beeves annually killed, 363,550; of small stock, 1,155,000. The number of hogs killed annually has been about 1,200,000, although it is said that during the present year the numbers will be something less, owing to a temporary dullness in the market. About half of this quantity of pork is for exportation. These figures, as I have already said, are only approximate, though obtained from the butchers by direct inquiry; yet for reasons which it is not necessary to speculate about here, butchers are not always ready to make known the full amount of their business. Besides the numbers above given, there is one establishment where 750 beeves upon an average, are slaughtered weekly for the foreign market alone, making at that rate, 39,000 annually for exportation. How to control this immense trade, and how to deal with the large amount of offal and refuse accompanying it, is a problem which has severely taxed modern science and modern ingenuity, and which finally admits of but one solution, — concentration, or the abattoir system.

To-day, however, New York can boast of but one abattoir, which is complete in all of its arrangements, and that is located at the foot of West Thirty-fourth Street, by the Hudson River. The building was erected for a market, is a fine specimen of architectural skill, and is substantial in structure; but not proving successful as a market, it has recently been converted into an abattoir, no expense having been spared to render it a model of convenience and of sanitary excellence. The appliances are such as to render the work easy; the ventilation is good, the floors are non-absorbing, easily cleansed, and the drainage is perfect. The tallow is rendered while perfectly fresh, and the blood and offal are utilized without delay, all of these operations being conducted in Craven dryers, the gases from which are run directly into the sewer, which discharges eight feet below the surface of the water at low tide, and are thus rendered inoffensive. The place is under good management, is thoroughly cleansed each day as soon as the work of slaughtering is finished, and instead of its being a nuisance, it is externally ornamental, and the internal arrangements are such that the work

is entirely hidden from the view of any one in the street. The cattle arrive by boat, and through an under-ground tunnel, are driven immediately from the landing-place to their pens without passing through any portion of a public street. This establishment was in active operation during the extremely hot weather of the past summer, and thus far has given rise to no well-founded complaint. They are at present slaughtering about one thousand beeves per week, though the capacity is sufficient for six or seven times that number.

The Butchers' Hide and Melting Association have a building on Forty-fourth Street, near the East River, with a capacity for slaughtering from five thousand to six thousand cattle per week. The building is 275 feet in length, and is divided into twenty-seven "balks" for the accommodation of as many butchers. It was the first building erected for an abattoir, and has always been kept in a good sanitary condition, though it has never received the encouragement from individual butchers which it deserves. The tallow is rendered in an adjoining building, the gases being passed through spray condensers, and thence into the sewer which discharges into the river about six feet below the surface of the water at low tide. There are no facilities here for treating offal and blood.

The Union Stock Yard Abattoir, at the foot of West Sixtieth Street, is well arranged for slaughtering, which is principally done for foreign trade. There are no facilities here for rendering fat, or for treating the blood and offal. The average amount of slaughtering at present is about 800 cattle weekly, nearly all of which are for the foreign trade.

The Abattoir at Harsimus Cove, Jersey City, is a well arranged establishment as it regards convenience, neatness, dispatch, and the sanitary interests of all concerned. The floors are non-absorbing, and may be flushed at any moment; the several compartments are separated only by iron railings, which, aided by movable skylights and side windows, afford every facility for thorough ventilation. The fat and offal are removed from the premises without delay, and the hides are salted immediately upon being removed from the animals. The annual amount of slaughtering at this abattoir has been, in round numbers, about 200,000 cattle, 300,000 sheep, and 600,000 hogs. The hogs are killed in a separate building, about three or four miles distant, on the Hackensack River, and it is to this place that the fat, offal, etc., from the abattoir are removed to be treated. The sanitary care of these abattoirs is undertaken by the proprietors, to whom the butchers are subordinate as to the hours of killing, etc. This regulation is necessary, in order that those whose work it is to clean the premises may not be interrupted or delayed.

Besides the abattoirs mentioned, New York has fifty-two separate and independent slaughter-houses, nearly equally divided between the east and the west sides of the city. Those on the east side occupy an area extending from Forty-third to Forty-seventh streets, including these two streets; and from First Avenue to the East River. Those on the west side are nearly all of them confined to an area extending from Tenth Avenue to the Hudson River, and between Fortieth and Forty-first streets. There are

three or four scattered ones above this, near the river; and there is also one at the foot of East One Hundred and Sixth Street. But few of these buildings are properly constructed, or have yards properly graded and paved, or drainage such as to be the cause of no special complaint. On the contrary, most of them are but poorly adapted to the purpose of slaughtering animals, by reason of imperfect construction, defective drainage, and a general absence of the necessary sanitary regulations, which cannot be successfully carried out so long as the business is conducted in detached places, each proprietor indulging in his own ideas of sanitary requirements. There are, also, in the recently annexed district, eight small slaughter-houses, for supplying the local wants, killing, in the weekly aggregate, about thirty beef cattle, and eighty small stock. These latter buildings are small, badly constructed, and generally deficient in sanitary provisions; but as the neighborhoods where they are located are somewhat thinly settled as compared with the city, perhaps the greatest nuisance in connection with them is the contamination of the water streams into which their drainage and washings are discharged, there being no system of sewerage in the district by which this could be avoided. This is particularly the case with a small stream known as Mill Brook, which, from receiving the filthy drainage of a large neighborhood, is reduced to a condition little above that of an open sewer.

The swine slaughtering establishments are all located near the Hudson River, between Thirty-ninth and Forty-first streets. At each of these places lard is rendered in steam tanks, the gases being in some condensed and discharged into the river, in others destroyed by combustion. At one of them, blood and offal are treated with the Hogel dryer, and reduced to a valuable fertilizer. All of these places are kept in good sanitary condition, there being no complaints except occasionally, from some imperfection or temporary derangement of the rendering apparatus.

It has long been the practice of the Board of Health to have frequent and systematic inspections of all of the slaughter-houses in the city, with a view of enforcing the sanitary ordinances. During the summer months these inspections have been daily, when careful note has been taken of everything pertaining to their sanitary condition. By these daily inspections, certain regulations are enforced, which would have been neglected, had the butchers not felt that they were under this daily surveillance. The inspectors insist upon the prompt removal of offal and manure, the daily cleansing of the premises, the frequent whitewashing of walls and fences, and that the buildings be kept in good repair. Notwithstanding these frequent and careful inspections, there still exist evils which are inseparable from this system of conducting the business in a number of small and detached buildings. Each establishment regulating its own hours of work, and its own time for cleaning, and each proprietor establishing his own standard of what he considers cleanliness, the neighborhood of a slaughter-house is rarely exempt from the noxious effluvia so closely associated with this business. It is not unusual to find, immediately after a slaughter-house and yard are supposed to have been cleaned, particles of offal adhering to

the walls of the building, or along the fences, or caught in the interspaces of the rough pavement; portions of manure adhering to the fences, or in the corners of the yard; pools of bloody water in the depressions of the uneven pavement, or streams of surface drainage, made filthy with manure and blood, finding their way over the adjoining sidewalk to the street gutter. These refuse portions of animal matter soon take on the process of putrefaction, and the atmosphere becomes in a short time loaded with the offensive odors peculiar to neglected slaughter-houses.

Another great evil connected with the distributed system, is, that it necessitates the driving of cattle through the public streets; a practice not only unsightly and annoying, but one that is often fraught with danger to the lives of citizens. It is true that where the business is confined to narrow limits at or near the water side, as in the city of New York, where the cattle may be landed from boats, the driving can be confined to streets in the immediate vicinity of the slaughter-houses, as is now the case in New York; the recent amendments to the sanitary code requiring that the animals be landed from boats on either side of the city, as near as possible to the place of slaughtering, and not driven across the city. Yet, even with this provision, there are no means of reaching their several places of destination, except by being driven through the streets leading from the river to the several slaughter-houses, and this generally in the busy part of the day, when the streets are lined with horses and butchers' wagons, and every condition obtains calculated to frighten the animals, and render them unmanageable, to the great danger of injury to passers-by, or to children residing in the vicinity. This practice of driving cattle along the crowded thoroughfares of a great city, a practice always annoying to citizens, and one that has cost many lives, might be wholly avoided by concentration of the slaughtering business within properly constructed abattoirs. The recent action of the Board of Health in adopting an ordinance restricting the driving of cattle in the streets, is regarded by the entire public — some of the butchers excepted — as a long stride in the right direction, and it only needs the completion of another step, that of concentration, to render the driving of cattle in the streets wholly unnecessary, and thus to relieve the public of a dangerous nuisance.

In order to reduce the business of slaughtering in large cities, to a condition more compatible with public health, safety, convenience, and economy, one, two, three, or even more — according to the amount of business — large abattoirs should be provided, and furnished with all of the modern appliances not only for expediting the work of slaughtering and handling the stock, but for the immediate and proper disposal of all parts of the animal not suitable for food. This latter branch is a highly important one, as the methods of dealing with offal under the existing distributed system of small butcheries, is one of the most repulsive and objectionable features of the slaughtering business. It is the offal wagons and the fat wagons going to and from different parts of the city, and the various rendering establishments distributed over extensive areas, that contribute so largely to the impurities of a city atmosphere, whereas concentration enables us to deal

with these matters at once, allowing no time for putrefaction to commence. It provides for the most approved machinery, which smaller and detached establishments cannot always afford, thus greatly modifying if not wholly abating the nuisance which attends every attempt to utilize animal refuse upon any other system, and does away with the many offensive trades which grow out of this, and are usually found scattered about in various localities. It also facilitates a careful inspection of the animals before being slaughtered, and protects the public against any danger from diseased meat which otherwise may be thrown into the market.

The abattoir system relieves the individual butcher from any responsibility concerning the general condition of the premises, and as the special conveniences are common to all, his expenses are much less than when occupying a separate establishment, on the principle that in all instances combination lightens the individual burden.

These abattoirs should be located remote from business centres and human dwellings, and as near as possible to the water, for the easy construction of sewers and the perfection of drainage, or what is better, if they could be made to project over the water where there is a good current, so that all waste fluids and washings could be at once discharged into the water, without the necessity of a sewer, it would complete the facilities for perfect drainage and cleanliness. They should also be located so that animals may be landed, either from boat or rail car, immediately on the premises without any possibility of finding their way into the public streets, thus securing the public from a great annoyance, to say nothing of occasional excitement and danger incurred in consequence of a frightened bullock escaping from the drove. This is one of the excellent features of the Thirty-fourth Street abattoir, where the animals are transferred immediately from the boat to the cattle pens, without any possible access to the street, where they are never seen.

In the city of New York this transition from the distributed to the concentrated system, is being brought about gradually by the steady maintenance of sanitary requirements, and the persistent enforcement of sanitary ordinances. By this continued pressure, commenced in 1866, the butchers were about eight years ago removed from various portions of the city to their present limits.[1] Previous to that time no portion of the city was exempt from the nuisance of cattle driving, and the atmosphere was daily receiving from more than a hundred different centres, the disgusting emanations from as many rudely constructed and still more rudely managed slaughter-houses. Street gutters were often flowing with blood from the slaughtered animals,

[1] The first effort at improving the condition of slaughter-houses commenced by the Metropolitan Board of Health, did not contemplate the abattoir system, but only relief for the city at large, by confining the business to limited areas, and thus preventing the accessory nuisances from being scattered broadcast over all parts of the city. It was finally accomplished only by long and persistent efforts, involving litigation, even to the Court of Appeals.

The result was gratifying to large numbers of citizens, though not satisfactory to all, for certain streets were still rendered unpleasant each day by offal wagons and droves of cattle, to say nothing of the faulty construction and defective arrangements of the slaughter-houses.

owing to defective, or total absence of, sewerage; the buildings became saturated with animal matter, and were therefore constantly tainted with the disgusting odor of animal putrefaction; the ground underneath the buildings became completely sodden with slaughter-house filth; and it was not unusual to see the nuisance extending to adjoining premises, and even to neighboring streets.[1]

Since the business has been confined to the present limits, the system of frequent inspections is more easily maintained, and the frequent repairs which the butchers are called upon to make in order to be able to continue their places in a condition suitable for the business, and the amount of labor necessary to effect the daily cleansing of separate establishments, have convinced many of the butchers that concentration will be less expensive to them than any further attempt to run their separate slaughter-houses, subject to these frequent orders from the Board of Health. At the same time, the man who has invested largely in the slaughtering business, sees in every pound of offal that is utilized, an inducement to perfect his facilities, that he may add to his own income in proportion as he contributes to the abatement of a public nuisance. He also sees that by concentration alone can the refuse portions of the animal be utilized with profit; that the fat can be

[1] When the Metropolitan Board of Health was organized in the spring of 1866, there were in the city of New York nearly two hundred slaughter-houses distributed through several of the wards somewhat as follows: In the Ninth Ward there were sixteen, four of which were south of Christopher Street. In the Fourteenth Ward, there were six; in the Fifteenth, one; in the Seventeenth, fifty; in the Eleventh, nineteen; in the Sixteenth, six; in the Eighteenth, seven; in the Twentieth, twenty-five; in the Twenty-first, four; in the Twenty-second, twenty-three; and in the Twelfth, seven. Here we have an aggregate of one hundred and sixty-four separate and distinct slaughter-houses scattered over a large, and for the most part a densely populated area. Each establishment constituted a centre from which were evolved and disseminated offensive and noisome odors to pollute the atmosphere of its immediate neighborhood during a greater portion of the time. In point of construction, these buildings presented almost every variety of unfitness for the business to which they were devoted. Indeed, many of them were such as had previously served for some other purpose, as stable or workshop, and were wholly unprovided with the proper facilities for conducting the business in a cleanly or inoffensive manner. As long as this system prevailed, no neighborhood, and no class of people could be considered as exempt from the possibility of being afflicted with this nuisance, save perhaps where the value of property might render the enterprise too expensive for profit. The evils which were inseparable from this distribution of the slaughtering business were by no means confined to the business itself. Not only were populous tenement districts, private dwellings, churches, and public schools exposed to the annoyance of a close proximity to some of these establishments, causing night to be made hideous with the noise of the restless animals, and the slumbers of the early morning to be disturbed by alarms and screams of the human animal in attempting to manage his unruly victim; but it also necessitated the dangerous practice of driving cattle through the public streets in nearly all parts of the city, so that at no time could it be regarded as absolutely safe for citizens to be in the streets with a drove of cattle in sight, lest at any moment some timid animal from being frightened at the noise and bustle of a crowded city might become infuriated by the misdirected efforts of men and boys to control him. The danger to be feared from the practice of driving cattle through the streets of New York, was not confined to business hours. The evening's recreation often met with the same disturbance; and citizens going to, or coming from, their places of worship, and children just assembling or just dismissed from school, were in equal danger of being tossed or gored by some unruly bullock escaped from the drove.

rendered while perfectly fresh, and in an inoffensive manner; that the blood and offal before having had time to putrefy, may be changed into comparatively inoffensive and valuable fertilizers; thus what was formerly a noxious waste becomes a source of profit to the individual, and of health and wealth to the nation.[1]

During the present month, or early in November, the separate slaughter-houses on the west side of the city will be closed, and their business removed to an extensive abattoir now being constructed at the foot of West Fortieth Street. This will relieve Tenth Avenue, Fortieth and Forty-first streets from the unsightly structures which have long disgraced the neighborhood, and settle the question of locality for many years to come. Similar arrangements are being made on the east side of the city, which will probably be completed during the present autumn.

In conclusion, I shall simply repeat what I have elsewhere said, that the sanitary interests of a city require that the business of slaughtering animals for human food be done in large abattoirs, where there is every facility for properly disposing of all parts of the animal; where the animals before being slaughtered may be viewed by a competent inspector; and that all meats placed in the market, should first have the approval of an efficient and conscientious sanitary officer.

As a basis for the further discussion of this subject, the writer submits the following resolution, for the consideration of this Association and of all public health authorities: —

Resolved, That concentration of the slaughtering business in large abattoirs, located at the water-side, below cities where possible, and remote from business centres and human dwellings, provided with facilities for utilizing all portions of the animal without delay, is regarded as essential for the protection of public health, and as conducive to individual economy.

[1] The transporting of offal, and indeed of all parts of the animal not suitable for food, through the streets to their different places of destination, was another great evil of the distributed system. The refuse was conveyed through the streets leading from the various slaughter-houses to the dock which had been set apart for the purpose, where a boat was lying in wait to receive it, often in the incipient stage of putrefaction, to the intense disgust of everybody along the several routes over which it passed, while the hides, the horns, the feet and the tripe, each conveyed in a different direction, contributed to overspread the city with noxious odors. It requires neither argument nor illustration to convince one of the superiority of a system by which the most offensive features of the business can be absolutely controlled, as can be effected by localization within a limited area, over the old system of allowing each individual to locate himself at will, and inflict his nuisance upon a whole neighborhood, a nuisance multiplying itself in proportion to the number of separate establishments in operation.

EXPERT TESTIMONY AND THE PUBLIC SERVICE OF EXPERTS.

By PROF. EMORY WASHBURN, LL. D.,
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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 4, 1876, IN OPENING THE DISCUSSION ON EXPERT TESTIMONY.

The nature, character, and necessity of expert testimony as evidence in courts.
The danger of its being abused and brought into disrepute by incompetent or dishonest witnesses testifying as experts, and how far this has been illustrated in practice.
Modes now in use, and such as have been suggested, for guarding against these abuses in the selection of competent experts.
What men of science owe to themselves to elevate the character of expert testimony, by discountenancing pretenders.

I HAVE been assigned the pleasant duty of presenting for the consideration of this Association such suggestions as may seem fitted to the occasion, in their bearing upon the subject of "Expert Testimony, and the public services of Experts in matters affecting Life and Health." The subject, it will be perceived, divides itself into two topics, to the first of which, for obvious reasons, I propose to confine myself. The importance of expert testimony in trials in courts can hardly be exaggerated, when it is remembered that it extends not only to controversies as to property and the rights of persons, of which courts take cognizance, but often to questions involving the lives of persons charged with the commission of capital offenses. To understand its bearings, we are to keep in mind the processes by which such questions are determined in courts. They subdivide themselves into two parts: one of law, the other of fact. The first of these devolves upon the court, or judge who presides at the trial. The other is referred to a jury, who have no other power or office in such trials than to find and report to the court the facts bearing upon the matters in dispute between the parties, and then upon the assumption that the jury have found these truly, the court proceeds to declare what the law is in its application to such a state of facts. Beyond the general intelligence and practical experience and good sense which are supposed to be common to all who are called to serve as jurors, the only medium through which juries are understood to divine the means of determining the questions submitted to them, is the *evidence* adduced before them, upon the adjudication of the court first had, that the same is competent and proper to be admitted. Much the largest portion of evidence adduced in courts for the guidance of juries in making up their verdicts, is the testimony of witnesses as to subject-matter within their *knowledge*. When, therefore, in such a trial a question is propounded to a witness, the first inquiry is if it is pertinent and proper? The next, whether the witness *knows* that of which

he is asked to testify? As a general rule he is not at liberty to offer his theory as to what the truth is, however ingenious or probable that may be. He has a right to state only facts, and not arguments or speculative opinions. There are various sources of knowledge to which a witness may resort in ascertaining a fact of which he is called upon to testify. He may have seen an act done, or heard the words spoken, of which he testifies, in which case he relies upon his personal *knowledge*. He may have occasion to refer to an event, or the condition of a place or region, for the facts in respect to which he must depend upon accredited works on history or geography, where his knowlege is reached through other media than his own consciousness. But, as a general proposition, witnesses are confined in their statements to what they *know* through their own consciousness. The exceptions to this, as we shall see hereafter, relate principally to the deductions of scientific investigations, or the results of legitimate processes of reasoning through what the witness already knows upon matters which relate to the question upon which the court and jury are to pass. The facts, moreover, which may be elicited during a trial, may often, when considered by themselves, be so far independent of each other, that neither may have any apparent relation to the main question upon which the parties are at issue. They may each form an important link in a chain, if the connection between them can be successfully established. It is in supplying this connection between what is otherwise proved by independent evidence, that the testimony of experts becomes important. And I may add, that in the constantly expanding field of abstract and applied science, the occasions are as constantly multiplying in which this class of witnesses are called into requisition. I can make myself better understood, perhaps, by supposing a trial in which a not unfamiliar train of circumstances becomes developed, in which expert testimony supplies the point upon which the case turns. A man is found dead. Upon examination of the viscera, certain appearances are detected which are perceptible to the senses of any observer, and which he can describe, though he may have no idea of what they indicate. The contents of the stomach may be subjected to analysis by a man of competent skill, who may know nothing of importance outside of this, beyond the fact that some person has died. Upon applying his analysis, he detects the presence of what he knows to be arsenic, though he may not know from personal observation what the effect of arsenic is in producing specific appearances upon human viscera. What these appearances should be, in order to conform to an established law of science, can, however, be authoritatively settled by calling in those who know what this law is. Suppose this is done, and it is discovered that a person who had had an opportunity to administer such a poison to the dead man, had purchased a quantity of arsenic fifty miles, it may be, away from the place of the death, a week or two before it had happened; and suppose, further, that it is shown that he had motives to seek the death of the deceased. We should in such a case have a chain of circumstantial evidence far stronger than that upon which many a conviction has been had, and the whole shall turn upon the testimony of experts, based upon what they know of the laws of science, though strangers to every circumstance connected

with the death. The same principle may be illustrated in a hundred different ways. A bridge gives way while a man is passing over it, and he sustains injury. He claims damages on the ground of the inadequacy of a bolt in its structure. The point may be settled by submitting the parts of the broken bolt to an expert in practical science, to be tested by experiment and the laws of science as to the quality of the material of the bolt, its size and form, and its capacity to sustain a given weight; and what he knows of these as an expert, may determine the fact of capacity or incapacity of a bridge of the existence even of which he personally knows nothing.

A large class of the cases in which expert testimony is employed, involve questions, the solution of which lies within the proper scope of science, or that something, of the knowledge of which we predicate certainty. A proper law of science, when once ascertained, is always the same, and whatever is established by it is accepted, in matters of proof, as a *fact*. If, from any given physical condition of things, the same result always follows, so that the one comes to be the *cause* of the other, we assume that this is by some uniform *law* of science. But to be a *law* it must be uniform and invariable. If, in ten experiments, the result is produced in nine and fails in the tenth, it ceases to be a law, and the most one could say, if asked if such a condition of things would produce a certain result, would be, that such would *probably* be the case. It is changed, in other words, from a *law* to a *probability*. And the difficulty with which we have to contend as to expert testimony is, to draw a line between a *law* and a *probability*, which, however strong, never rises to a *fact*. Thus, in the case supposed, if one who is offered as an expert, has tried but a part of these ten experiments, and has found the same result to follow, we might, from his point of knowledge, pronounce it to be a law, and be honest in so doing. And yet the one who has repeated it till the truth has demonstrated the contrary, knows that it is not a law, though he may not know how the variance he has detected may have arisen. In the one case the witness is an empiric, in the other an expert. Each may be equally confident, and yet only one can be relied on with confidence.

Here, then, is the danger of employing *professed* experts as witnesses, and accepting the conclusions of which they testify, *as facts*, upon which juries are to rest their verdicts. In the first place, if they are deficient in a knowledge of what a law of science is, or in the skill and learning which are requisite to its applications to the facts in the given case, their testimony may be false in fact, and may mislead the jury who shall accept it, although the witnesses themselves believe what they say. If I believe spiritualism to be a power, and testify as an expert that certain phenomena are caused by it, I may be honest in my testimony, though every word of it may be adverse to what other professed experts regard as the laws of science. Nor is it easy, if possible, to escape this difficulty, since it is always competent, and often the only way, to establish the fact that one is an expert from his own statement under oath. He takes upon himself to say that he is able to distinguish between what is true and what is merely probable; nor would there be, in most cases, any mode of detecting or punishing his perjury, if in this he were to swear falsely and corruptly.

Another inherent difficulty in accepting conclusions of so-called experts as facts, however honestly made, grows out of the complex nature of the facts which they have to assume as *premises* from which to draw their conclusions. As I have stated, experts are ordinarily called to state what is or would be true of a certain assumed state of facts, of the truth of which they personally know nothing. The surgeon hears some one describe a certain wound, and is asked if it was adequate to cause death. He has not seen it, and whether it would cause death or not might depend upon a variety of attendant circumstances. Some witnesses, before testifying, would be careful to inquire into all these before forming a judgment. Others would find enough to sustain a satisfactory theory from a portion only of them. And in giving their evidence each may be desirous of telling the truth as he understands it. And this is, undoubtedly, a mode by which courts are often able to reconcile the painfully conflicting evidence of expert witnesses testifying in the same case, which has at times brought the testimony of experts into positive disrepute.

I might illustrate this by the case of Palmer, which was tried in the English courts in 1856. He was charged with the murder of one Cook by poison. Cook died very suddenly, exhibiting symptoms of tetanus. It was contended that Palmer had a motive to take Cook's life, and was shown to have purchased a quantity of strychnine just before his sickness. The contents of the stomach after death were subjected to chemical analysis, but no strychnine was found. Fifteen or twenty, some of them the most distinguished chemists and physicians in England, among whom may be named Taylor, Christison, and Sir Benjamin Brodie, were called and examined upon the trial, — about the same number upon each side. A portion of these testified that the effect of strychnia taken into the system is to produce such tetanus as accompanied Cook's death; others testified that it might be produced by wounds or natural causes, though exceedingly rarely, if ever, from natural causes in that climate. The great point of discrepancy in their testimony was whether, if death ensues from strychnia taken into the stomach, it can be traceable in the stomach on the tissues; and upon this, the witnesses were about equally divided, each being equally confident and positive in the theory he maintained, though one of them was of opinion that Cook died of *Angina pectoris*. That testimony so diverse in regard to the same state of facts, should have come from witnesses professing to be experts in a matter of science, and many of them above suspicion of sinister motives, occasioned, as I have intimated, general and severe animadversion on the part of the courts and the public. Cases scarcely less significant have occurred in our own country, alike damaging to the credit due to expert testimony, among which I may mention that of Mrs. Wharton, in Baltimore, in 1872, and that of Dr. Schœppe, in Pennsylvania, who after a conviction, and after the gallows for his execution had been erected, was granted a new trial and his innocence established. In both these cases, the charge was poisoning, sustained by the oath of a professed expert, and in one of them the presiding judge at the trial declared that "he did not know of any case in the annals of criminal jurisprudence,

which, from the evidence submitted in the case, had so baseless a foundation for so grave a charge."

Another class of cases in which expert testimony is largely employed, is that in which questions of sanity or insanity are involved. The radical difficulty in the way of such testimony in these cases being satisfactory, much less conclusive, is found in the very nature of the subject to which it relates. The operations of the human mind are often so subtle, that it is impossible to reduce them, in any given case, to a standard, if, indeed, there were a standard to be applied. But since no two minds are alike in all respects, the nearest test to be applied to individual cases is not the comparing of one man's mind with another, but with something like an assumed average of such minds as the would-be experts shall have studied and observed. And even this can, at best, be but an approximation to the true quality and state of the moral and intellectual faculties of any one at any particular point of time. The great difficulty, therefore, in the use of expert testimony upon questions of a man's moral and legal responsibility for what he has done, or of his intellectual capacity to perform certain acts which come under the cognizance of the law, is the tendency to generalize or raise theories from partial or inadequate premises of facts. To one witness, the strange and eccentric conduct or language of a man he meets may be satisfactory proof of a deranged or insane intellect, while to another, who may have known him from his infancy, these may be only the abnormal forms in which a sound intellect is accustomed to manifest itself. Within our own State, an eminent and learned expert has maintained upon oath, the theory that a man from a state of sanity may suddenly become, and, for a brief time, actually be so insane as to be irresponsible for acts done while in that state; and after having committed a homicide, for example, may as suddenly be restored to a sound state of mind, though in the same trial an expert, called upon the other side, was equally confident that such could not be true.

It was not, therefore, to be wondered at, that the chief justice of the court who presided at the trial, took occasion to remark to the jury: "I think the opinions of experts are not so highly regarded now as they formerly were, for while they often afford great aid in determining facts, it often happens that experts can be found to testify to any theory, however absurd." And yet expert testimony in cases of questionable insanity is not only often resorted to, but is, at times, the best evidence that is to be had, though it must, from the nature of the case, amount only to the expression of an *opinion*, and wants the element of *certainty*, as in the case of a fact in science. And it is in this class of cases that the qualities of a true expert are especially needed, — large experience, accuracy of observation, clearness of apprehension and discreetness in judging, united with honesty of purpose. Such witnesses come within the category of *experts*, although that of which they testify can often be only judged of by approximation to the truth.

Another class of these problematical cases, where experts are found to differ, is that of persons who are called morally insane, when the very atrocity of the act done tends to relieve the party committing it from respon-

sibility. A case in this neighborhood, within the last two or three years, has led to much public animadversion as to how it should be dealt with. But it is enough for my purpose, that when such distinguished names as Ray and Gilman are, as I understand them, on one side, and Sir Benjamin Brodie on the other, the question may be regarded as one upon which the testimony of an expert can hardly claim a higher rank than raising a *probability* instead of establishing a *fact.*

There are other cases where courts and juries are exceedingly embarrassed by experts conflicting with each other upon matters which to unscientific minds seem capable of being made certain, instead of being left in the region, as they now are, of greater or less probability. One of these occurred in this vicinity, two or three years ago, where experts were arrayed against each other upon the question whether the corpuscles of blood of a man can be distinguished, with certainty, from those of the lower animals, — a horse for example. This, it would seem, must be a physiological fact which might have been settled by comparison and observation, and if such be the case, till it has been done, the testimony of an expert in respect to it must, at best, be only conjectural.

Hence arises the importance of a witness being properly qualified by a *knowledge* of what he is to testify, before offering himself as an expert. And one great reason for this is, that the jury are not supposed to be experts themselves, or able to discriminate between the effect to be given to the testimony of either, where two or more conflict with each other. And in the next place, it is hardly less important that, in testifying, an expert should honestly distinguish between what he *knows* and which is to be accepted as a *fact*, and what he *believes* upon the score of *probability*. But even this, if properly stated, though not a fact, may have an important bearing in determining the weight to be given to other probabilities in the case, in reaching a satisfactory conclusion by the weight of the evidence.

Thus far I have confined myself to the case of experts who intend to state *honestly* what they know, or think they know, to be true after a careful and deliberate examination of the facts involved in the questions which they are called upon to answer. The necessity and importance of such testimony, I repeat, are every year becoming better understood, as the domain of science grows broader and more replete with subjects. And in the hands of honest men the chief drawback to its value arises from an imperfect knowledge or defective process of reasoning on the part of the witness. But, unfortunately, this does not cover the whole class of witnesses who pretend to be experts, and are offered as such in our courts. A smattering of science but imperfectly checks, even if it does not stimulate, base purposes and mercenary motives. And whoever is at all familiar with court proceedings, has been fortunate, if he has not seen and encountered exhibitions of expert testimony from witnesses hired, like the counsel in the case, to carry a verdict by the skill and ingenuity with which conjecture is put forward as *fact*, — partial truth made falsehood by suppressing that with which it is connected, and science prostituted to dishonest purposes. On this point I shall content myself with the language of others whose opportunities for

judging cannot be questioned, after reminding you of what I have already said, that from the fact that such witnesses testify to *opinions* alone, if they are willing to sell their reputations for science for such a price as an employer is willing to pay, they can do it with substantial impunity.

In Palmer's case the Attorney-general said: "I have no language to express my abhorrence for the *traffic testimony* which, from professional pique or for the sustentation of a particular theory, men of science, I grieve to say it, occasionally are led to offer." The Chief Justice, in charging the jury, said: "There were also gentlemen whose object was to procure the acquittal of the prisoner. It is in my opinion, indispensable to the administration of justice, that a witness should not be turned into an advocate, nor an advocate into a witness." And a writer in a leading English law periodical adds, "Let it be remembered that if it should ever, unfortunately, become a well recognized fact, that there is a regular *witness market* where may be procured scientific, professional, or technical evidence, as it may be wanted, the most dire consequences must ensue."

Lord Campbell, in addressing the House of Lords, while commenting upon the testimony of an expert in the matter of handwriting, used this language: "I dare say he is a very respectable gentleman, and did not mean to give any evidence that was untrue. But, really, this confirms the opinion I have entertained, that hardly any weight is to be given to the evidence of what are called scientific witnesses. They come with such a bias on their minds to support the cause in which they are embarked, that hardly any weight should be given to their evidence."

Mr. Taylor, an accredited writer upon the Law of Evidence, when speaking of experts, says: "These gentlemen are usually required to speak not of *facts* but of *opinions*, and, where that is the case, it is often quite surprising to see with what facility, and to what extent their views can be made to correspond with the wishes or the interests of the parties who call them. They do not willfully misrepresent what they think, but their judgments become so warped by regarding the subject in one point of view, that even when conscientiously disposed, they are incapable of expressing a candid opinion. Being zealous partisans, their belief becomes synonymous with *Faith*, as defined by the Apostle, and it is, too often, but the substance of things *hoped* for, but *not seen*."

If, therefore, honest and honorable gentlemen find themselves sharply and suspiciously cross-examined, when testifying as experts, they might find, in experiences like these, less occasion for charging unfairness on the part of men of my own profession, than many of them are now willing to acknowledge. The experiences of unfortunate Tray, in the fable, have a wider application than the canine fraternity of which it is told.

If now, it is asked how this grave and difficult subject can be managed so as to slough off, as it were, unworthy men from the class of expert witnesses, while competent and honest ones are retained, I answer, the attempt has been made, at different times, by different nations, according to the nature and character of their judicial systems, some of which I will mention. In Prussia, they have a Toxicologist, who is appointed by the government, and

a permanent Commission of experts in matters connected with medical science, whereby, it is said, Prussia has "the best corps of experts the world has ever seen." In Scotland, medical witnesses, we are told, deliver their examinations in writing. But they are there subjected to an oral cross-examination in open court, whereby, at times, they are sharply reminded of errors and omissions in the premises and processes by which they may have reached their conclusions. In France, it seems, the judges, in cases requiring the examination of experts, decide who shall act as such, and what questions shall be submitted to them, where the parties in interest fail to agree upon these points. Their answers are required to be in writing, and are submitted to the jury as evidence, but are not regarded as conclusive, although, in general, they are practically so. In England, much speculation and various schemes have been suggested for obviating the objectionable features of expert testimony; but, thus far, it is believed, without the adoption of any system. One plan has been to have a certain number of experts form a part of the jury who are to try the case. Another has been to have the questions which require the testimony of experts in any case, first settled by a special jury consisting of experts, and their decision to be adopted as a fact in a hearing of the whole case before a common jury. Another plan has been to select a certain number of experts who shall sit with the judge on the trial of a case, and advise him in the matters which come within their province. But it is apprehended, that neither of these would be in harmony with the spirit of our trials in court, where judges exercise great caution in excluding any competent witnesses whom a party may see fit to call, or in controlling the mode of their examination, so long as the same is conducted within the rules prescribed for the management of such trials. A plan which has found favor with many who have examined the subject with attention, is to have the court before which the trial is to take place, select a proper number of experts of an established reputation, after a proper hearing of the parties, and to have these called, while the parties may still be at liberty to call others if they see fit. The effect would be that the testimony of experts appointed by the courts would carry a weight with an impartial jury, altogether greater than mere ex parte witnesses selected on account of their known predetermined opinions. It would add a dignity and importance to the office of an expert which is merited, although, as things now are, it is becoming seriously impaired from the character of those who take it up for the pay it brings. And, in the end, it would go far to exclude this latter class from a service which they have done so much to dishonor. This plan has been again and again pressed upon the attention of the Legislature of Massachusetts in successive years, but with indifferent success, although no committee has yet seen fit to favor the public with the reasons why some such measure should not be adopted to remedy an evil which every one who has given the subject a thought has not failed to perceive. In the hearings before the legislative committees, four of the leading associations for general and medical science in the Commonwealth were represented by the very class of men who know and illustrate what belongs to the character and office of an expert witness. But the measure failed for

reasons which conjecture only can supply, unless the disfavor with which the proposition has been received by some of the legal profession may have arisen from an apprehension that, after such a charge, the language of a writer in the "Albany Law Journal" might no longer be justified, which says: "In fact, the calling of experts has now come to be regarded as the signal for a display of *forensic* pyrotechnics, beneath whose smoke and lurid glare, law, common sense, and unalloyed justice are swept away in a whirlwind of misty metaphysics." One reason, at least, why some such measure has not already been adopted, is the want of knowledge, and, consequently, the want of interest in the subject in the public mind. In this view of the question, every man of science, whatever may be the department in which he has made its laws a study, owes it to himself and the dignity of his calling, saying nothing of the interests of truth and justice, to do what he can to educate and enlighten the public mind to understand and appreciate the proper character and office of an expert, upon whose testimony the property and even the life itself of the citizen may depend.

To a certain extent, high-minded, honorable men of science have a remedy in their own hands, and owe it to their own self-respect to give it its full application.

There are quacks and pretenders in every calling and profession, but, for the detection of these, the public have to depend upon the men of science who are best able to expose them. Let them in their intercourse with each other show that they properly appreciate the distinction between merit and pretense, in the same way they do between a gentleman and a blackguard. There is no occasion to raise an open crusade, on the part of men of science, against a worthless mountebank and pretender. It only gives him a seeming importance for the time being, which serves the purpose of notoriety at which he is aiming. The true method of dealing with such men is contempt, the contempt with which one regards the man who cheats by false pretenses, or wins by false cards at the gaming table.

The public need honest and capable lawyers. The public must have expert witnesses to carry on the business of their courts, and serve the great purposes of law and justice. Nor can their selection, their qualifications, or the manner in which they acquit themselves of their office, cease to be objects of personal interest in every community.

Considerations like these, I trust, will serve as an apology, if it need one, for the length of time which I have occupied on this subject. The occasion, and the men of science to whom I was to address myself, seemed to demand a frank and full presentation of the difficulties which surround it. I could nowhere hope to find a body of men more competent by learning, observation, and the habits of scientific investigation, to understand and appreciate the true character and qualities of one who worthily fills the place of an expert in giving evidence in a court of justice.

The subject addresses itself to every one of you as men of skill and science, and as honest and honorable men, to vindicate in your own conduct and opinions the respect that is due to high attainments, generous purposes, and manly courage.

The following propositions, by Dr. Wolcott Gibbs, were submitted by Henry P. Bowditch, M. D., and the discussion of the subject was continued by Drs. Bowditch, Steiner, and Horsford, and Professor Ordronaux, Commissioner in Lunacy, N. Y. [See Minutes of Meeting, end of this volume] : —

" Under the present system, as adopted in courts, the testimony of scientific men is not brought out *fully and fairly*, and the community suffer in consequence.

" In some other countries, a different plan is pursued by which the testimony of men of the highest scientific standing is received in *writing*.

" It is possible to devise a plan, by which the objection of scientific men to appearing in courts of law may be avoided, and by which a broad line of distinction may be drawn between scientific men and the professional experts who represent simply one side of a question."

The following resolution, offered by request of Dr. Wolcott Gibbs, was unanimously adopted by the Association : —

Resolved, That a committee of five be appointed to inquire what methods of obtaining Expert Testimony prevail in European countries, and to report at the next meeting of the Association the recommendation of an improved plan of procedure based upon the information thus received.

EXPERT SUPERVISION OF THE CONSTRUCTION AND INTERNAL ARRANGEMENT OF PUBLIC INSTITUTIONS, WITH THE VIEW OF PREVENTING INJURY TO THE HEALTH OF THEIR INMATES.

By LEWIS H. STEINER, M. D.

READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 4, 1876.

The progress of civilization is marked by an increasing interest in the physical, mental, and moral wants of man, on the part of the State.

The State is responsible for the supervision and protection of certain physical and mental wants of the people.

In providing for those wants, special institutions are considered indispensable, such as hospitals, etc., schools, etc., and churches, etc.

Permanent buildings are needed for the accommodation of such institutions.

In these buildings the greatest care should be taken, lest they should, on account of defective construction, be productive of detriment to health.

The injurious consequences of defective construction are manifested mostly, not in violent, acute disease, but in maladies of a low type and chronic nature.

These injuries to health are found in houses for religious worship, in buildings designed for educational purposes, and also in those erected for the accommodation of the sick, helpless, and infirm.

The remedy is to be looked for in two directions, namely: (1) In the alteration of buildings at present employed for such purposes; and (2) in the employment of proper sanitary supervision of all new structures.

Relief from these perils can only come from the employment of *competent experts* to supervise all plans for public buildings.

To make expert supervision most effective, it should be made imperative by the State.

CONCLUSION: In the construction of all public buildings intended to meet the physical, mental, or moral wants of communities, the best expert supervision should be insisted upon by the State, so that no detriment be done to the occupants thereof, in consequence of their faulty location, construction, or arrangement.

I. THE progress of civilization is marked by an increasing interest in, and care for, the physical, mental, and moral wants of man. The State, in its relations to the community, is called upon to exercise, to a certain extent, the functions of a parent towards his offspring, so as to protect citizens from injuries while they shall seek all that is necessary for the satisfaction of their wants. Necessarily, the State must guard against so unwisely extending this parental care as to interfere with personal responsibility. In other words, she must so plan this supervision of her citizens as to provide that, on the completion of their pupilage, they shall be allowed to think and act for themselves under certain limitations, and to become component portions of her own strength and prosperity.

II. In providing for the three classes of wants referred to, experience has found it best that the State should be held responsible for those that are physical and mental, without interfering with the Church in its care for such as pertain to man's moral nature. In other words, starting with the theory that the State and Church are separate and distinct institutions, we strive practically to restrict each to its own sphere. The State is then ex-

pected to care for the health both of body and mind, and the Church to have the superintendence of all that concerns the moral nature. There may be those who would gladly recognize the Church as entitled to supremacy in regard to the whole class of duties recognized here as belonging to the State, and possibly some who would cordially support any efforts to subordinate the Church to the State; but the great majority of Americans are ardent supporters of the theory that the two are distinct in essence, and should be kept so, if their highest usefulness is to be secured.

III. In providing for the physical, mental, or moral wants of men, certain institutions are considered in the present age indispensable. For physical wants there must be hospitals, asylums, almshouses, etc., supported partly or entirely by their inmates, or wholly eleemosynary in their character; for mental wants, educational institutions are needed, ranging from the village primary school, through the varying grades of the grammar school, the academy, the college, industrial, scientific, and technical institutes, up to the university. For moral wants there must be suitable edifices for public assemblage and instruction. These institutions have become more extensive and more perfect as experience and the advance of civilization have demonstrated their necessity, and as men have acquired greater skill in their management. This improvement has been more marked in the last half century than in any other period of history of equal length, and has been most manifest among communities that are most advanced in civilization.

IV. As such institutions have assumed definite shape, the necessity of permanent structures for their accommodation has been everywhere recognized, and in their construction architecture has employed both the conveniences and adornments which the inventive genius of man has devised. In such structures an excellent opportunity is afforded for practically testing any new inventions or discoveries that have been brought forth under the stimulus of special necessity. The objects of the institutions themselves ought to be more certainly attained in buildings thus constructed and furnished than in any others. The latter *may* accidentally be well adapted for the uses of the institutions; the former *should* be wholly arranged for the objects which they are intended to serve. And to this end all that science and art can bring to bear, all that money can command, all that intelligent zeal can furnish, should be so employed that there may be a constant improvement in such material contrivances as are needed to accomplish the purposes of the institutions themselves.

V. The greatest care should be taken lest these buildings themselves, with their appointments, be productive of direct or indirect detriment to the health of their inmates. This object, although obviously of the first importance, has been and is being neglected to an extent beyond the conception of those who have not studied the subject. The study of sanitary science, fortunately no longer confined to the medical profession, but claiming attention now from members of other professions and pursuits as well as from the public generally, has directed attention to this subject; and now, that personal health is necessary to personal success, and that public health is a prerequisite to public wealth, are questions no longer open to discussion,

but admitted as facts, it becomes an imperative duty to tolerate nothing which will impair health where an attempt is made to provide for physical, mental, or moral wants. All the antidotes to poisons that science can possibly furnish will be of little avail, unless we put an end to the continuous admission of the poisons themselves into the human system, and our efforts to bring aid to needy humanity will fall short of their object unless health is guarded from all that may impair or undermine it. As the injury will fall upon all classes and conditions of society, all are alike interested in adopting such preventive means as will be most efficacious.

VI. The pernicious influences of buildings, constructed without due regard to ventilation, light, and heat, upon the health of their inmates, are rarely, if ever, demonstrated in the production of acute disease that challenges attention by its violence, but in chronic affections which slowly but surely sap the foundations of health, and shorten life in a thousand different ways. Hence errors of construction and internal arrangement do not attract the attention of the ignorant, or the superficial student. They slowly and insidiously obstruct the channels of health, — introduce friction where all should move smoothly and noiselessly, clog valves that should be free, introduce obstacles in vessels through which unobstructed currents should ceaselessly flow, dull and blunt sensations that should be lively and acute, and fetter mental operations that should be free and unhampered. They act like insidious poisons, which furnish no immediate alarming indications of their presence, but having acquired mastery in detail over all the functions of the body, by one mighty destructive effort put an end to life itself, while science is powerless to furnish the needed antidote. Hence they are more dangerous than acute pestilence or active contagion, because the blow is given in the dark, — the deadly dart is hurled from the secret recesses of the ambuscade.

VII. Injuries to health arising from errors of construction in buildings occupied by public institutions, occur in those designed to meet each class of the wants peculiar to man.

(1.) In chapels and churches, as well as in lecture rooms and halls, where men are assembled only for brief periods of time, the sanitary defects in construction are not likely to produce permanent injury to health ; but even temporary inconvenience, *malaise*, or indisposition, although short in duration, should not be tolerated. The attention of the architect, or builder who has assumed the name of architect, in the majority of buildings belonging to this class, would seem to have been wholly occupied with the effect of the exterior upon the eye, and his energies directed to make this strictly conform to some definite style of architecture, or to display in it a wondrous composite of his own invention, no reference being had to the uses for which it was intended. Light is admitted through windows placed wherever their insertion does not interfere with external form and ornamentation, and the windows themselves are of such size as will harmonize with the design of the exterior ; ventilation is accomplished through the door-ways, possibly, or by means of the windows, should the sexton or janitor chance to raise them, and proper temperature is secured in the like accidental and

inadequate manner. The last thought of the designer would seem to be the health of those who are to occupy the structure. As a result of this, we have sermons delivered, in a stupid and uninteresting manner, to hearers whose somnolence from carbonic acid, and other oppressive gases, unfits them for mental attention.

(2.) This deleterious result of defective structure becomes still more serious and injurious in buildings especially intended for schools and colleges. It might be supposed that the objects of these institutions would certainly be kept in view in the erection of buildings for their use, and that the architect would first arrange the interior to meet these objects and to protect the health of the occupants, and *then* to invest the whole with an exterior of such architectural style as would not mar this arrangement. Such would be the common-sense plan in preparing a building of this character, but another mode has been generally employed. The exterior is first decided upon, with the view of setting forth some fashionable style of building, and then — the interior is forced to conform to this style. As a result we have, even in many costly and capacious buildings, intended for educational purposes, an utter unfitness for the use to which they are dedicated, — requiring in some instances an entire reconstruction of the interior. Pupils, in consequence of defective sanitary arrangements, are victims of headache and lassitude, and unable to concentrate thought upon any subject; the ruddy cheek of childhood and youth pales from want of the chemical influences of the solar ray, their natural elasticity of spirits is changed into senile dullness and torpor, and disease finds subjects ready for the display of its power. True, such sanitary impediments to mental development may be, and sometimes are, overcome by a strong effort of the will, prompted by youthful ambition, — but the result attained is always secured at the cost of health, and sometimes of life itself. While such perils are connected with attendance upon some of our modern schools, they were unknown in the village school of former days, because imperfections in the building furnished innumerable apertures for the admission of air, and even light, and thus compensated for the ignorance or carelessness of the builder. Now, however, the building is made air-tight, and its occupants, within its closely-sealed apartments, are obliged to perpetually test the question, " How long can a human being live in a room unsupplied with fresh air and adequate light and heat ? "

(3.) In an examination of buildings designed for the accommodation of the sick, wounded, helpless, and infirm, or that class whose bodily wants require public aid, we ought to find that sanitary science had been called in to superintend their construction, in order that the object of the institutions — restoration to health and useful activity — might certainly be secured. But the same defects in construction, alas, meet us too often here also! Hospital wards, reeking with poisonous emanations, that make the contest for life to the patient more doubtful than if he had remained without, whose corridors and halls are saturated with disgusting odors, due to defective sewerage and lack of ventilation, as well as to absence of cleanliness! Asylums for the helpless and infirm, where the stimulating influences of sun-

light and pure air are denied their inmates! Surely such institutions are not fitted for the relief of human suffering, but are pest-houses that should be tolerated no longer in the nineteenth century, and in a country alive to the necessity of bringing succor to the needy and suffering.

VIII. The remedy for the evils that have been thus briefly and summarily presented, is to be looked for in two directions: (1) by having errors of construction in buildings at present in use corrected as far as possible; and (2) by the employment of intelligent supervision of all new buildings intended for religious, educational, or philanthropic purposes. The former presents obstacles that may be in many cases insurmountable, in consequence of the difficulty experienced in making the necessary alterations, but the latter simply requires that all the resources of sanitary science should be made available in the primary construction and internal arrangements. Experience having made us acquainted with defects that are detrimental to health and life, and science having furnished us knowledge of the mode by which such defects may be avoided, it becomes an imperative duty that the aid of the latter should not be neglected.

IX. The remedy is to be found in the employment of *experts to supervise* all plans for buildings intended for the class of public institutions already noticed, so that they may be free from all defects that will be injurious to the health of their occupants. Prevention may thus be employed, and the necessity of complaint on account of subsequent unfitness obviated. But an expert is produced, not by birth, but by special education and training; he is not a sciolist or empiric; he becomes such only after much study and extended investigation and observation. He is, as defined by Webster, one who has "skill, experience, or peculiar knowledge on certain subjects of inquiry in science, art, trade, or the like," and sanitary experts are such as have "skill, experience, and peculiar knowledge" of sanitary science and its applications. To *such* experts all plans for public institutions should be submitted for revision and correction, and no building should be occupied until it has been approved by the same authority.

X. To make this expert supervision most effective, it should be made imperative by law. The extraordinary powers of the old Roman *senatus consultum*, — that the Consuls should take care lest the Republic suffered any harm, — were granted only when imminent danger was at hand. It recognized the consuls as officers fitted by natural and acquired talents to provide for the emergency, and reposed confidence in their ability to make such provision. Here is seen a monstrous, growing evil, — buildings for religious, educational, and philanthropic purposes, constructed so as to be detrimental, either temporarily or permanently, to their inmates, — and these inmates are frequently the young, the sick, the helpless, and infirm. Shonld not the State invest sanitary experts with such supervision of these buildings as will protect the inmates from physical harm while they are looking for benefit within their walls? Nay, must she not in some way attain this end, if faithful to those whom she is expected to defend and protect from evils which threaten without and within, and imperil the well-being of her citizens? And if so, how can it be so effectively accomplished as through the employment of experts, clothed with adequate legal authority?

XI. The conclusion which we have reached in our discussion may be thus stated, "In the construction of all public buildings intended to meet the physical, mental, or moral wants of man, the best expert-supervision should be insisted upon by the State, so that no detriment be done to the inmates thereof in consequence of defective construction or internal arrangement."

NOTE. — The limits of the volume required some abbreviation of the foregoing paper, for which the Publishing Committee are responsible. The report of the discussion which followed the reading of Prof. WASHBURN's and Dr. STEINER's papers is unpublished, except as it appears in the Minutes.

THE RIGHTS, DUTIES AND PRIVILEGES OF THE COMMUNITY IN RELATION TO THOSE OF THE INDIVIDUAL IN REGARD TO PUBLIC HEALTH.

By JOHN S. BILLINGS, M. D.,
Surgeon U. S. Army, Washington.

AN ADDRESS AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

Individual effort cannot secure the best protection to health and life; concerted action by compulsory legislation and skilled supervision being necessary for this purpose.

To what extent has the community or a majority of it a right to interfere with the liberty of the minority for the sake of public health without rendering compensation for the damage it may thus inflict?

Much of the work of medical charities tends to propagate disease and crime by perpetuating debasing hereditary influence.

As legislation of some kind is proposed in all plans for the preservation and improvement of public health, it is highly desirable that members of the legal profession should be induced to take an interest in the subject, and to advise as to what laws are expedient or practicable to do away with the causes of disease pointed out by physicians. We want some sanitary lawyers as well as sanitary engineers.

One of the objects of the American Public Health Association is declared by the second article of its constitution to be, "the promotion of organizations and measures for the practical application of public hygiene." This recognizes the importance of concerted action of the many, for the effective preservation of the health of the individual. It is almost impossible that any one man living and working with his fellows, can, under present conditions, obtain at all times pure air, water, and food.

Many of the papers heretofore presented at the annual meetings of the Association have more or less strongly insisted on the fact that individual efforts are not sufficient to secure the best possible protection to life and health, but that compulsory legislation and skilled supervision are necessary for this purpose. Underlying all discussions and recommendations of sanitarians in this direction is the belief, usually accepted as axiomatic, — that the pleasure and profit of one or a few persons are not to be regarded if detrimental to the welfare of the many, and all that is to be considered is whether the particular law or regulation proposed is for the greatest good of the greatest number.

It is a good thing occasionally to examine, with some care, axioms of this kind, and to make sure of their soundness; the question then arises, To what extent has the community, or a majority of it, the *right* to interfere with the liberty of the minority for the sake of public health without rendering compensation for the damage thus inflicted? This word "right" has, as you know, several significations. From the legal point of view, an act

which is just, is nearly equivalent to an act which is generally useful, and we cannot oppose right to expediency, since they are here the same. It is in this sense that I use the word, but I find the legal maxims with regard to it somewhat contradictory. Jurists state that mutual benefit entails mutual responsibility, and as explained by Ordronaux: "The foundation of the mutuality of obligation subsisting between men in civil society, rests upon the doctrine that each member has rights of which he cannot, with propriety, be divested; and that in the exercise of these rights, and in the ordinary transactions of every-day life, he is entitled to a *quid pro quo* for every advantage, privilege, or favor, granted to another."

Justice, when abstractly considered, ignores Charity, and compels no man to the performance of any act for which a moving consideration or advantage to him has not existed, or will not exist in the future. The whole circle of civil obligations, as contradistinguished from natural or imperfect ones, may be expressed by the maxims of *do ut des*, *vel facio ut facias*. From this point of view it would seem that when the State says to the individual citizen, You shall not, as heretofore, allow the waste from your factory to contaminate the stream upon which it is placed; you shall not slaughter cattle in the buildings which you have erected for that purpose; you shall not build a house on a certain lot of yours unless you make the walls of a certain thickness and arrange the timbers in a certain way: — when she says to the physician, You shall keep certain records and make certain reports in order that we may know what are the rates and causes of mortality; and to the householder, You shall ventilate your sewer connections in a certain way, and you must put in a particular form of trap, — it would seem at first sight, that these persons should be compensated by the community for this abridgment of their liberty, or for the service which they are compelled to perform.

It is evident that the question thus raised cannot be answered by the usual statements with regard to liberty, since even John Stuart Mill, in his treatise on that subject, while declaring that "the sole end for which mankind are warranted in interfering with the liberty of action of any of their number is *self-protection*, and that his own good, whether physical or moral, is not a sufficient warrant," does not seem to think any compensation is due, if the interference is in behalf of self-protection; and this of course never occurs to those reformers and improvers who claim that every man has a right to demand that every other man shall be compelled to do just what he ought to do. I should be disposed to accept the reasoning of Mr. James Fitzjames Stephen, who states that if the object aimed at be good, if the compulsion employed be such as will attain it, and if the good obtained fully overbalances the inconvenience of the compulsion itself, then the compulsion is right and proper.

It is from this point of view that the merits of laws affecting the public health must be considered. The practical answer to the question just raised is that no compensation is due, that the State is authorized to pass such laws as it may deem proper to secure the health of its citizens, provided it does not interfere with commerce, or the rights of other States. To those who

like physicians, have occasion to consider the causes of disease, the following queries often occur: —

If it is the duty of the State to make vaccination compulsory, why should not the enforcement of the ventilation of dwelling-houses be equally proper and commendable? If articles of food known to be unwholesome may be seized and destroyed by public officials, why not apply the same principle to insanitary clothing, and do away with high-heeled shoes, certain forms of corsets, and "stove-pipe" hats, in the same manner? If the rights of the individual are as little or nothing when weighed against the good of the community, why should we not pay more attention to the future condition of the race, since our obligations extend to the next generation as well as to those now living?

We are beginning to take steps whereby a village on the head-waters of a stream shall not be allowed to pollute with its sewage the water which is to supply the great city below. Why not also endeavor to prevent the contamination of our children's children by hereditary influences from the insane, from criminals, or from those affected with cancer or consumption? To what end do we apply all the resources of modern science and art to preserve the lives of the thousands of men and women in our asylums, hospitals, and prisons, of many of whom it may be said that it were better they were dead than alive? We employ our best physicians and engineers to make sure that the air, water, and food of these persons shall contain nothing detrimental, and after keeping them awhile, and getting them into the best possible condition, we send them out into the community, living and moving sewers to propagate mental and physiological deformity and disease without limit.

Every day, and in all parts of our country, the little children are being inoculated, as it were, with cancer, or syphilis, or tubercle, or nervous diseases, — such as chorea, or epilepsy, or insanity, or the alcoholic diathesis; and are not certain efforts of sanitarians and humanitarians calculated to increase rather than diminish the evil? Are their efforts, then, to be discouraged? The answer is, No; for the good effected is, upon the whole, greater than the evil produced; and on the other hand, the idea of some progressive reformers, that the State should supervise the marriage relation in order to promote the health of its citizens would, in our present state of knowledge, certainly produce more evil than good. As stated by Dr. Wilks,[1] "It is no doubt fearful to think of a man or woman marrying with a strong taint of insanity, and bringing into the world a family of lunatics, but it does not follow that an infusion of the insane blood may not be desirable. I think that it might be easily shown that such infusion has given genius to a whole family, — it has leavened the whole mass."

I only wish to remind you that medical charities and improvements in hygiene of certain persons and classes, do not produce unmixed good, and that in our plans and propositions for reform and improvement we should not shut our eyes to possible evils. It has been well said, that "Calculation is the guide and not the antagonist of sentiment. It is the rudder to the

[1] *Journal of Mental Science*, January, 1875, p. 514.

soul. Sentiment without calculation were blind and capricious, but calculation without sentiment were inert." Whatever may be the limits which we may think proper to impose on the actions of the individual for the good of the community, or on the interference of the community with the freedom of the individual, it is evident that we can do comparatively little to improve the public health without legislation of some kind. This being the case, is it not desirable that those whose business it is to deal with law and legislation, should be called in to advise in regard to such subjects? Probably no one of us knows precisely what is the existing state and power of the law in regard to the prevention of, or punishment for, injuries to the public health, for there is a vast amount of law which is not made by legislatures, nor to be found in the statutes. Our judges are making laws every day, or what is practically the same thing, interpretations of laws, and these interpretations are again interpreted by other judges, and so on. But we might at least endeavor to interest some of those who are most familiar with the principles of law in the subject which we are considering, and obtain their opinions and advice upon these problems which are directly in the line of their thoughts and studies. Public hygiene is as much a matter for study by the lawyer as by the physician or engineer, and the best results are to be obtained by combining the knowledge of the three. To quote from Mill: "Government and civil society are the most complicated of all subjects . . . . and he who would deal competently with them as a thinker . . . . requires not only a general knowledge of the leading facts of life . . . . but an understanding exercised and disciplined in the principles and rules of sound thinking, up to a point which neither the experience of life, nor any one science or branch of knowledge affords."

In this country, legislation on public health must be mainly a matter for individual States. The general government cannot interfere with police matters, and the only way in which it can touch the subject is through its rights to regulate commerce, and to protect the health of its army and navy, that is to say, by legislation and quarantine regulations.

We have heard a good deal during the last few years about a national health bureau, and several bills have been introduced into Congress looking to the formation of such an institution. But such a bureau can do nothing except collect information. This is a very important function, it is true; it is precisely what this Association is trying to do, and what it probably could do fully as well as any government bureau that is likely to be established, if it had the same amount of money at its command.

It is to State and Municipal boards of health, and to some organization yet to be devised which shall secure concerted action between these boards, that we must look for all positive and effective action in this matter. Among the present difficulties in the way are, — First, our want of precise knowledge of the causes of disease. Second, our want of a means of testing the real value and usefulness of the various measures of preventive medicine of which we may make trial, — which means must be a registration of diseases and of mortality; and for providing this, very careful and well-considered legislation is necessary. Third, the fact that in none of our educational in-

stitutions is provision made for the proper education and training of persons for the duties of health officials, and that there is therefore a terrible scarcity of men properly qualified to fill these important and responsible positions. The result of this is that incompetent men are often appointed for political reasons, no better candidates presenting themselves. Fourth, and finally, that it seems to be assumed by the majority of people that the business of providing for the public health belongs especially to physicians, and that they are to be the only active workers on this subject.

The fact is that in this field there is as much need of the thought and work of lawyers, of engineers, and of architects, as of members of the medical profession, and that all of these must interest themselves in this subject if good results are to be obtained.

Of late years we begin to hear of a few names of sanitary engineers. Architects now often pay some attention to problems of ventilation, drainage, etc.; but it seems to me that the members of the legal profession have not given sufficient consideration to the subject of the public health, and the problems which it presents to them in the proper adjustment of the legal relations of the individual to those of the community, — in short, that we need some sanitary lawyers in this Association, and in official positions where they can originate or direct legislation relating to this specialty.

This last want is just at present perhaps the most urgent of all, since were it supplied we might hope to obtain good registration laws, without which scientific public sanitation is not possible, and this again would rapidly lead to the bringing to public notice the dangerous points in a city or county, which being effected, we may be sure that some remedy will be provided.

THE INFLUENCE OF PRIVATE DWELLINGS AND OTHER HABITATIONS ON PUBLIC HYGIENE: THE RELATIONS OF SANITARY AUTHORITY TO THEM.

By STEPHEN SMITH, M. D.,

New York.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 4, 1876.

Every family in domicile is a perpetual source of unhealthfulness to itself and to the neighborhood by the constant outflow of excrementious matters, and the accumulations of waste animal and vegetable products.

From this source arise many of the chronic invaliding maladies which slowly waste the vital energies of the people of a community, and from the same source spring many of the most fatal and wide-spread endemics.

It is demonstrable that the causes of sickness and mortality incident to the household may be so effectually controlled by adequate contrivances and intelligent supervision, that they are rendered entirely harmless.

Experience proves that the family, whatever may be its social rank, does not secure adequate appliances, nor exercise that vigilant care, necessary to the entire control of the causes of sickness and mortality from this source.

Skilled engineering, architecture, and supervision, under the direction of competent sanitary authority, can alone be relied on to fully protect the household and the community from the dangers incident to health and life in domiciliation.

In the Annual Report of the Registrar of Vital Statistics of the city of New York, for 1873, there is a small table which embodies a volume of suggestions to sanitary authorities. It is a statement of the percentage of total city mortality among the tenement house classes of the population, for the six preceding years. It is as follows: —

1868	1869	1870	1871	1872	1873
75.7	68.9	66.2	66.4	66.0	64.8

From this table it appears that during these six years the mortality in the tenement houses fell upwards of eleven per cent., while the mortality in the private residences increased.

In order to fully understand the significance of this table, and the practical lesson which it teaches, it is necessary to explain a feature of sanitary work during that period by the Board of Health. On the organization of the public health service of that city, in 1866, careful limitations were set to the sphere of its active duties. In regard to the inspection and supervision of the dwellings of the people, it was determined to subject the tenement houses only to regular visitation and surveillance. Accordingly, twice in each year, these residences were carefully and systematically inspected from cellar to garret, and every defect in their sanitary condition, as far as practicable, was remedied. Repairing, cleansing, lime-washing, ventilation, were enforced in every part and apartment. Besides these semi-annual inspections,

the tenement houses were more or less frequently visited in the interval in the search for causes of disease, and the rules and regulations of the Board have been so rigidly enforced that it now requires little more than the suggestion of the health officer to insure compliance with every demand. While the policy of the Board was thus stringent in regard to the sanitary condition of the homes of the poor, it carefully avoided those dwellings classified as private. A man's own house was regarded as his personal concern, and in that sense he was to enjoy the privilege of living as he pleased, provided he did not break the peace, nor commit a flagrant nuisance.

Now it happens that in New York the population is about equally divided between those living in tenement houses and in private dwellings, there being about half a million of each class. We have here, then, an opportunity of testing the value of sanitary inspection and supervision of families in domicile.

At the commencement of the period mentioned, when the inspection was undertaken, 75 per cent. of the total annual mortality fell upon the tenement house residents. That is, one half of the population furnished 25 per cent. of the deaths, while the other half furnished 75 per cent. of the deaths. After eight years of persistent sanitary care of the homes of the poor, and entire official neglect of the private dwellings, we have the results summed up in the comprehensive tables referred to. This table shows a steady and positive decline in mortality of that portion of the population whose domiciles were the subject of stringent sanitary surveillance, while, on the contrary, there was a steady rise in the mortality of that class of people whose domiciles remained unexamined. And these facts are the more significant when we consider the difficulties attending sanitary improvements of the tenements of New York.

It is noticeable that the most marked decline in the mortality occurred between the years 1868 and 1869, the decline being seven per cent. Now, it was in this year that a most searching inspection was made of every apartment occupied by a tenement house family, followed by reconstruction, cleansing, and disinfection; a single item improvement was, the construction of nearly 50,000 ventilating windows in these dwellings during that year.

We have in these facts the most positive evidence of the value of sanitary supervision of households. In six years the death-rate of half a million of the worst housed people was reduced eleven per cent. as a direct result of that supervision, while, during the same period, the health of the people living in their own domiciles, and entirely independent of supervision by health officers, gradually deteriorated.

The principle which governs authorities in their discrimination is based upon legal distinctions as to the public character of the tenement houses, and the purely personal character of private dwellings. A house let to many families is held to be peculiarly liable to generate nuisances "dangerous to life and detrimental to health," and hence the necessity of inspection to protect the inmates from accumulating sources of sickness which they neither recognize nor remove. But a family able to live in its own house is placed beyond the pale of ordinary obligations in sanitary administration, and en-

joys immunities of an extraordinary character. In its individual capacity it is an isolated entity, having no social relations with the general community.

We hold that the construction placed upon the legal principle which recognizes the right in general of every citizen to manage his household affairs as he pleases, debarring the State the right to inquire into and regulate them, so far as they affect the public health, is pernicious, and ought to be changed. In other words, we maintain that the highest interest of every family in a community, and of the community as a whole, requires that every dwelling and every family should be the subject of systematic official sanitary visitation and supervision.

The following propositions are submitted with a view to contribute somewhat to a radical reform in the treatment of private and other residences by municipal boards of health, — in other words, to enforce the cardinal principle, "*the house is the unit of sanitary administration.*"

Every family in domicile is a perpetual source of unhealthfulness to itself and to the neighborhood by the constant outflow of excrementitious matters, and the accumulations of waste animal and vegetable products.

Probably no more offensive remark could be made of any family, in its own home, than that it is a nuisance. And yet is not that what may be truthfully said of every family living in its own domicile? For what is a nuisance? By the laws of the State of New York, a nuisance is defined to be: "Whatever is dangerous to human life or detrimental to health; whatever building or erection, or part or cellar thereof, is overcrowded with occupants, or is not provided with adequate ingress and egress to and from the same, or the apartments thereof, or is not sufficiently supported, ventilated, sewered, drained, cleaned, or lighted, in reference to their or its intended or actual use; and whatever renders the air, or human food or drink, unwholesome." On one or several of these counts every family in our present social condition, whatever may be its rank and character, may be convicted of being a nuisance. Let us examine this subject in the light of existing knowledge of what is "dangerous to life and detrimental to health," and see how far the families of this or any community are amenable to the law.

And, first, what is a family? The common definition is as follows: "The collective body of persons who live in one house, and under one head and manager." Or a family is "a household, including parents, children, and servants, and, as the case may be, lodgers and boarders." It is generally estimated that there are five persons on an average in a family, and, accepting the above definition, the members consist of parents, children, servants, boarders. We have, then, five persons representing both sexes and all ages living permanently together on a limited area, and in apartments adapted to their various necessities as a household. Living in this aggregate capacity, isolated from all other families, they must, in the small space allotted to the home, prepare and eat their food, wash their soiled linen, dispose of slops and excreta, sleep at night, and perform all necessary domestic acts.

First, let us inquire as to the *increment* of this family. Every adult person is estimated to require daily about forty ounces of solid food, and sixty

ounces of water. This estimation would give to one family of five persons, twelve and a half pounds of solid food, and two and a half gallons of liquids. The food required for one year would be 4,562 pounds, and water about 1,000 gallons. The substances which enter into these foods are albuminous, fatty, carbo-hydrates, and salts. In their preparation a percentage is disposed of as waste in the kitchen, and the remainder is subjected to the process of cooking with high degrees of temperature, during which there is a loss of twenty to thirty per cent. Much of this loss is water, which, in its conversion to steam, carries off volatile portions of the solids, which are diffused in the air of the house, and are largely absorbed by the walls, clothing, furniture, etc. This finely divided matter is in a state to take on putrefaction and fermentation whenever the conditions of warmth and moisture are favorable. Under these circumstances, they furnish a soil in which many low forms of vegetable life germinate. The food, once prepared, is in part consumed with various condiments, and in part — often the largest part — rejected in the kitchen as waste, and thrown into the common garbage heap. The 1,000 gallons of water consumed enters the system either as a part of the food, or as a beverage.

Let us examine next the *excrement* of the family. The weight of an adult changes but little in the course of a year, while that of the child increases ; but so far as the amount of food is concerned, we may account the weight of the members of the family unchanged. The food taken therefore, is a measure of the waste and repair going on constantly in the living being. These thirty-five pounds of food daily consumed must daily reappear as waste matter, or excreta. Of these thirty-five pounds, nearly eight pounds are discharged by the lungs ; ten and a half pounds by the skin, fourteen by the kidneys, and one and two thirds by the alimentary canal. What is this excreta discharged with such profusion from every part of the body? From the lungs of the family, sixty cubic feet of carbonic acid gas is daily given off into the air, with ammonia, putrid organic matter, and water, in the form of vapor. The carbonic acid gas is equally diffused through the room, but the organic matter and vapor are not as diffusible, and adhere to and penetrate clothing, walls, and porous articles. The ten and a half pounds discharged by the skin is vapor, carrying other waste tissues of the most offensive putrid character. If we wish to test the sensible qualities of the matters thrown off perpetually and insensibly, by the lungs and skin, we have but to confine the air of the room for a few hours in which a single person is sleeping, and then inhale it. The kidneys pour out volumes of waste tissues in a state of putrefaction, while the alimentary canal discharges the residuum of food, with the products of the excreting and secreting glands which cover its surface or lie in its course. Those various excreta are not only no longer useful to the organism in the form in which they are discharged, but for the most part are extremely poisonous. Respired air cannot be again safely breathed, nor can the excretions of the skin, or kidneys, or bowels, or secreting glands be long suspended without a dangerous accumulation of these waste matters in the system.

It is apparent, therefore, that the physical life of the family is an incessant

change, — a constant absorption of food, and a perpetual outflow of the waste products of the body, and of the food and fluids taken for its nourishment. Wherever it locates permanently, it immediately fills the surrounding air with poisonous gases and vapors, and saturates the earth beneath with fluids charged with the elements of disease and death.

It follows that living in the aggregate capacity of a family, in a fixed habitation, the constant tendency must be to the creation of those nuisances which depend upon the presence of human excreta. And this tendency is inherent in all families alike, and one differs from another only in the varying efforts made to prevent accumulations.

From this source arise many of the chronic invaliding maladies which slowly waste the vital energies of the people of a community; and from the same source spring many of the most fatal and wide-spread endemics.

It is quite unnecessary to prove that human excreta in the forms mentioned, and the excreta of the kitchen, laundry, and accessories, are dangerous to life, and detrimental to the health of the inmates of the house, within and around which they are allowed to accumulate. It is not apparent to many, however, that the community suffers from the dereliction of individual families, and hence the hesitation of authorities about subjecting families, living isolated, to sanitary visitation. But the proof, that from this source arises much of the ill-health of communities, is abundant. The exhaustive inspections of the rural districts of England furnish the most complete evidence of the disastrous effects of household filth upon the public health. In large numbers of the towns a low state of general health was directly traceable to the accumulations of the ordinary excreta of families. Diarrhœal diseases were extremely prevalent, giving rise to chronic ailments which incapacitated laborers, and enfeebled women and children. That household excreta were the cause, was proven, by the disappearance of those affections in proportion to the care with which scavenging was effected. The introduction of a properly constructed sewer, with house connections through a street of private residences, often at once improved the general health of the residents.

But house filth does not long remain in the condition in which it is first discharged, but takes on other forms, from putrefactive or fermentative changes. It is owing to these peculiarities that it forms a very proper nidus for the propagation of infective matters of various kinds. The germs of enteric fever and cholera deposited in such a hot-bed are enormously increased, hence, the spread of these affections in districts where the local filth of families most abounds. And the same is doubtless true of many fatal endemics. It required but the introduction of a spark in the combustible mass to awaken an apparently latent pestilence.

It is demonstrable that the causes of sickness and mortality incident to the household may be so effectually controlled by adequate contrivances and intelligent supervision that they are rendered entirely harmless. That dwellings may be so constructed, and so supplied with internal appointments, as to protect a family from their own excreta, with proper care, there is tangible evidence. Ventilation may be so perfected, that air made impure

by the family shall not remain in the apartments sufficiently long to be respired. The solid and liquid excreta can be instantly disposed of in such manner as to render them entirely harmless. The kitchen and laundry may be so arranged that their gases and vapors cannot reach other apartments. Heating and lighting may be effected without befouling the air of the house. The cellar may be dry, with air as pure as that of the external atmosphere. The death-rate in the model tenements of Peabody, Waterlow, and Coutts, compared with the death-rate of the same class in the ordinary tenement, enables us to appreciate the great advantage of the proper construction of a house. The difference of death-rate in those dwellings is twenty to thirty per cent. There have been instances in New York in which, by reconstruction of a tenement under the direction of a competent architect, the death-rate has fallen forty per cent. in one year.

But it is not construction and appliances alone that are necessary to preserve a house from contamination by the excreta of a family. There must always be intelligent supervision. The best machinery cannot be automatic, and the most inefficient can be made useful by intelligent care.

Experience proves that the family, whatever may be its social rank, does nct secure adequate appliances, nor exercise that vigilant care necessary to the entire control of the causes of sickness and mortality from this source. It may appear absurd to affirm that an intelligent private family, earnestly seeking to preserve and promote its health, cannot be relied on to perfect all needful house arrangements, and exercise proper care in all matters pertaining to cleanliness. But when we examine the details of the house, and the routine of management which is entailed upon the housekeeper, there can no longer be any doubt as to the liability, if not the necessity, of failure. Consider for a moment the house in which the family resides, and the methods adopted to dispose of those various forms of excreta, or rather the methods of accumulating domestic filth. The cellar is an excavation in the ground walled up with loose stones. It is intended to be the storeroom of the dwelling for perishable food, and is supposed to best answer its purpose when cold and damp. Standing water in the cellar, and damp, mouldy walls, are not regarded as harmful but rather beneficial. From dampness to large collections of standing water, even at times covering the cellar bottom, we may find every degree. Who that spent his early life in the country, does not recognize the truthfulness of the description of the cellar of the house in which he lived, as given by a New England judge. He says: "You creep half way down the cellar stairs with only the light of a single tallow candle, and behold by its dim glimmer an expanse of dark water boundless as the sea. On its surface, in dire confusion, float barrels, planks, hoops and staves, without number, interspersed with apples, turnips and cabbages, while half-drowned rats and mice scramble up the stairway for dear life, and drive you affrighted back to the kitchen." A writer estimates that the cellars of half the dwelling-houses in the country resemble the one here described. Now, what must follow in such a dwelling? Why the upper part of the house is always warm in the summer by external, and in the winter by internal heat; this high temperature above

constantly evaporates the water or dampness of the cellar, and sends its vapors, laden with mould, foul gases, and putrid organic matters, throughout every room of the entire house. Very frequently those vapors are so nauseous that the whole house is pervaded with the odor of mould.

Notice next the kitchen and laundry ; they are not only one, but they are so constructed and located that they communicate more or less directly with all other parts of the house. What is the consequence? When used as a kitchen the air of the dwelling is filled with the odor of the foods in the process of being cooked. And what is this odor,— sometimes appetizing, sometimes nauseating? In the cooking of foods, a percentage is thrown aside in the kitchen as waste ; the remainder is subjected to high degrees of heat by boiling or broiling, during which there is a loss of twenty to thirty per cent. in weight. Much of the loss is water, which in its conversion to steam, carries off volatile portions of the food, which are diffused throughout the air of the rooms. This finely divided animal and vegetable matter is in a state to take on putrefaction or fermentation, whenever the conditions of warmth and moisture are favorable. Driven off in the vapor, these minute organisms penetrate every part of the dwelling and every porous substance, and find lodgment in the walls, the beds, the clothing, and the upholstered furniture.

When the room is used as a laundry, the house is filled with the vapors of the steam. Now, the body and bed linen of the family are necessarily saturated with the excretions of the skin. Those excretions consist of the waste products of the body which have accumulated for a week or more. A part of the process of washing is the boiling of the dirty clothes. A temperature at the boiling point will volatilize most of the excretions in the clothes and enable them to escape with the vapor, and these, sent off with violence, are driven into all parts of the kitchen and dining-room, and penetrate frequently into sitting and sleeping-rooms. They lodge upon the meats, bread, and vegetables ; adhere to tables, table linen, plates, knives, and other furniture, to the walls, the bed clothes, and carpets. Nor does this accumulation of putrefactive animal and organic waste, from cooking and washing, remain in its place of lodgment as inert matter. It forms a hot-bed in which germinate vast numbers of low organisms.

Notice the *walls* of many kitchens and adjacent rooms, — how begrimed! Rub your hand over them. What a putrid odor! See the reddish and greenish streaks in the wall ; these are the ancient signs of the plague of leprosy affecting the walls. Place an atom of this filth from the surface under the microscope, and see how it teems with vegetable growth! Germs of typhus, of diphtheria, of small-pox, of scarlet-fever, and of a thousand nameless diseases may lodge in these filthy walls, ready to be detached and enter the sensitive throat, lungs, or stomach, of children, and excite fatal disease.

Notice next the provisions for house slops : they are either cast out upon the ground at the kitchen door, or into house drains. If thrown upon the ground, they form a cesspool of putrefying or fermenting filth, which every one incontinently shuns. If this collection of putridity simply evaporated, and only filled the air with its noisome gases, — its dangers, great though they

are, would have a well defined limit. But that is not the extent of its damage to the household. In that cesspool the most active chemical and vital changes are incessantly going on. New forms of life appear, live, and die within each twenty-four hours. They arise and float on the air, and thus pervade the dwelling, or are carried down into the earth with the wash, and enter the well, making its waters cold and sparkling with its salts. Throw into that seething mass a germ of typhoid, cholera, or diarrhœal poison, and it at once multiplies and propagates itself *ad infinitum*. These germs may arise and enter the house, or penetrate the soil and enter the well; in either case the members of the family are their recipient.

If the slops are delivered by house-drains, these as generally constructed are well contrived apparatus for conducting and distributing sewer or cesspool gases into every room of the dwelling.

Notice next the method of disposing of the most noisome excreta of the family, — that of the kidneys and bowels. If out of doors it is but a vault in the ground with porous earth bottom. Why do these vaults so rarely become full? Because the principal portion penetrates the earth, and thus passes away. But where does it go? The volatile elements fill the surrounding air, while of the more solid matters, part reaches the well and the cellar, part comes to the surface at lower levels of the adjacent grounds, and the remainder is dissipated in the soil-waters. Families living upon higher grounds thus always pollute the wells, cellars, and soils of their neighbors who are located at lower points. By at least two methods these excreta may again be taken up by the family, and experience proves that in vast numbers of country dwellings, the members are unconsciously slowly poisoned in this manner. If the receptacle is in-doors the apparatus is in effect well arranged to fill the house with its emanations. The modern city dwelling, or hotel, is now so constructed as to be little else than a collection of sitting and sleeping rooms arranged around the terminal extremities of branched outlets of sewers.

Finally, the methods of heating and lighting are so constructed as to fill the house with irrespirable gases. If the furnace is in the cellar its heat draws the gases from the soil long distances, and thus they are distributed over the house. This gas is largely carbonic acid, but there are added various gases from decomposing matters located considerable distances away, in privy vaults, stables, etc. Lighting by oil or gas creates an immense amount of carbonic acid gas, with other poisonous products of combustion, which we have no methods of removing from the air of the living room.

Skilled engineering, architecture, and supervision, under the direction of competent sanitary authority, can alone be relied on to fully protect the household and the community from the dangers to health and life incident to domiciliation. The reform in sanitary administration necessary to reach and remedy this evil must be aggressive and radical. The construction of dwellings of every description must come under the supervision of that branch of sanitary authority which represents expert knowledge in architecture and engineering. The plans of every proposed dwelling should receive the approval of such authority, in all their essential details relating to drain-

age, ventilation, heating, and lighting, before the work is begun. It is not necessary that every architect should be an expert, to secure such reforms as are suggested. He would only be required to conform to prescribed rules in details which affect the healthiness of subordinate parts of the dwelling. Nor would such administration in any manner interfere with the rights and privileges of the house-owner. Recognizing the fact that every dwelling, improperly constructed in the particulars previously determined, is a public nuisance, because detrimental to health, there would be no hardship in avoiding such errors in construction.

But, as has been shown, the best constructed house is a complex apparatus, which is neither automatic in its operation, nor permanent in its durability. It requires for its successful management the skillful supervision of an expert, and the watchful care of the sanitary officer.

The great want of American communities to-day is sanitary architecture in our dwellings, and sanitary supervision in their management. Domestic diseases, now so fatal, cannot make headway against pure air and cleanliness. But, to be effective, communities must combine as members of a single family, and make the reform radical. A single dwelling located in the midst of filth must be polluted even by the external air. All dwellings should therefore be treated alike as nuisance-producing, and be placed under the jurisdiction of competent sanitary authority. When this is done, as it surely will be in the not distant future, such filthy diseases as typhus and as typhoid fever will be unknown, and diarrhœal affections will occur only from improper food. Diphtheria, scarlet fever, measles, and the whole brood of domestic diseases will be shorn of their malignancy, and such epidemics as cholera will find no foothold on our shores.

II.

DANGEROUS EMPLOYMENTS AND HARMFUL PROCESSES.

ILLUMINATING GAS IN ITS RELATIONS TO HEALTH.

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A brief description of the principles of gas manufacture.
(*a.*) Coal gas.
(*b.*) Water gas.
(*c.*) Petroleum gas.
Noxious constituents of the various kinds of illuminating gas.
Injurious or offensive products evolved during the manufacture, purification, and combustion of the gas.

In the limited time allotted, it will be impossible to give more than a brief description of the processes in the manufacture of illuminating gas, and only those will be referred to which have a bearing upon the sanitary questions before us.

Illuminating gas is made almost exclusively from bituminous coal. For this purpose, bituminous coal is distilled in a closed retort, and evolves certain gases and vapors, some of which are combustible, and some, like steam, are condensable, a residue of coke being left behind. This process is the most important of the operations in making coal gas, and also appears to have the greatest influence upon the health of those employed in the works. But, in addition to this, it is necessary, before the gas is delivered to the holder, to remove from it those vapors which can be condensed, such as tar, water, etc., and also those non-condensable gases, which either diminish largely the illuminating power, if left in the gas, such as carbonic acid, or which, when the gas is burned, give rise to products of combustion which are injurious, such as sulphuretted hydrogen and ammonia. The removal fo these necessitates two other operations, — condensation and purification, the latter of which may or may not prove a nuisance to the whole neighborhood of the works, according as it is done properly or not.

First, as to the distillation of the coal. This is performed in iron or clay retorts, three, five, six, or seven of which, according to circumstances, are heated with one fire of coke to a high temperature. From 160 to 200 lbs.

of coal are usually introduced into the retort at a time, the lids closed, and the operation allowed to continue uninterruptedly for four or four and a half hours. At the expiration of this time the retorts are opened, the hot coke raked out, and a fresh charge of coal introduced. The coke is wheeled to some convenient place and quenched with water. The men engaged in tending the retorts are very liable to become affected with more or less severe affections of the respiratory organs. Dr. Petersen, city physician of Copenhagen, has published the results of his researches respecting the maladies of the employees at the gas-works of that city: "Of 338 cases treated, 200 were among the retort tenders; 266 of the cases were non-surgical, and of these ninety-six were of chronic or severe affections of the respiratory organs, fifty of catarrhal dyspepsia, twenty-eight of general debility, with fever, and twenty-six of rheumatic affections. The more serious respiratory affections in gas employees generally arise from prolonged catarrh, and, for the most part, consist of symptoms of bronchitis and phthisis, and of these cases, eleven per cent. were of persons possessing originally strong constitutions." There are two causes which contribute to this result. First, the exposure to very great variations of temperature. The top of the retort-house is always open, in order to permit the escape of the products of combustion from the fires, and in most places the sides of the retort-house are entirely open, or contain large doors, at short distances from each other, through which the coal may be brought, and the hot coke wheeled away. This condition of things occasions, necessarily, draughts, and excessive changes of temperature in the winter season. In addition to this, it appears probable that the coal and coke dust add somewhat to the cause of the catarrhal affections of the respiratory organs.

The gas passes from the retort, through the hydraulic main to the condenser, thence to the washers, where most of the ammonia is removed, and finally to the purifiers, where those noxious substances, not removed by the condenser and washer, are taken away from it. These substances are chiefly carbonic acid and sulphuretted hydrogen. The objection to carbonic acid in gas is, that it lowers the illuminating power very greatly. The sulphuretted hydrogen and other gaseous sulphur compounds are injurious, by giving rise in burning to sulphurous and sulphuric acids which may injure delicate structures, such as books, gilding, silks, etc., that may be exposed to the air of a room in which gas is burned. There is quite a difference of opinion among scientific men as to the injurious effects of sulphur in illuminating gas, but the weight of evidence appears to me to be greatly in favor of the statements of those who maintain that it is very injurious, and should be removed from gas as thoroughly as possible. Where large quantities of impure gas are burned, it causes a rapid destruction of textile fabrics with a very acid condition of them. This was especially noticed in the large public libraries in London many years ago, the covers of many of the books in the Athenæum Club-house, the College of Surgeons, and elsewhere, becoming destroyed by the sulphuric acid from the burning gas. The amount of this acid was so great, that it could be easily tasted by applying the exposed portions of the books to the tongue. Plants are quickly killed by the products of

burning gas, since they are peculiarly susceptible of injury from the presence of sulphurous acid in the air; according to Drs. Christison and Farmer, as little as one part in 10,000 of air will kill plants in less than twenty-four hours. And you cannot use gas in a conservatory, either for heating or for illuminating purposes, unless the products of combustion are entirely removed.

According to Mr. Chas. Heisch, Superintending Gas Examiner to the Corporation of the City of London, when sulphur is burned in a moist atmosphere (as is always the case with illuminating gas), the amount of sulphurous acid formed is quite insignificant, nearly all of the sulphur being converted into sulphuric acid, which is a vapor readily condensed on the walls of, and articles contained in, a room. Each grain of sulphur, in burning as it does in gas, gives rise to the production of just over three grains of sulphuric acid; one hundred cubic feet of gas, if they contain thirty grains of sulphur (a very common amount), would in burning produce ninety grains of sulphuric acid; and three burners, each burning four feet per hour, would produce between three and four grains of sulphuric acid per hour, or about twenty grains in six hours, which would in great part be condensed on the contents of the room in which the gas is burned. One very striking instance, in proof of the above, is given: "Some years since gas was introduced at the Royal Observatory in place of camphene lamps, for the photographic registration of magnetic variations, etc. In a very short time the surface of every reflector was destroyed, and the draw tubes of the telescopes quite corroded. It was found necessary to place a tube over each burner, and to connect all of these with a central chimney, in which a strong draught was maintained to carry off the products of combustion. These tubes were, for cheapness, made of zinc. In a few days all of the lamps were found extinguished by a crystalline substance, which dropped on the burners from the tubes. This proved to be sulphate of zinc. To prevent this, a contrivance was resorted to, by which the condensed matter was run into a vessel at the side of the chimney, and in one of these vessels there was collected in six weeks, from a burner consuming only about a half foot per hour, three-quarters of a pound of sulphate of zinc."[1]

It is impossible to remove the sulphur entirely from gas, but nearly all of it may be got rid of. The English law requires that gas shall be absolutely free from sulphuretted hydrogen, and that the amount of sulphur in other forms of combination shall not exceed twenty grains (or in some works twenty-five grains) per one hundred cubic feet.

To remove the sulphuretted hydrogen, carbonic acid, etc., several methods are in use, the material used being lime and oxide of iron. Lime is used both in the wet and dry way. The wet lime process consists in passing the gas through milk of lime. This effectually removes the carbonic acid, uniting with it to form chalk, and takes away most of the sulphur compounds by uniting with them to form calcic sulphide or sulpho-carbonate. The wet lime is, however, very objectionable on account of the foul

[1] *London Journal of Gas Lighting*, December 29, 1874, page 856.

odor evolved from it when removed from the purifier, so that exclusive purification by wet lime has been generally abandoned. The dry lime process consists in passing the gas through moistened slaked lime placed upon trays. This is about as effective as the wet lime process, and is generally used in this country, but has been largely complained of as a nuisance where the works are situated in thickly settled districts, on account of the noxious and offensive odors evolved from the lime when removed from the trays, so that in New York city the companies have been compelled by the Board of Health either to resort to special apparatus for ventilating the lime and consuming these gases, or to use the iron oxide mixtures for purification. In this city (Boston) a combination of the wet and dry lime processes is used. The wet lime through which the gas is first passed, and which retains most of the foul gases, is drawn from the purifier through a series of boxes and settling basins before the water finally comes into contact with the air when there is but little stench arising from it; and the dry lime, when spent and removed from the purifiers, has no unpleasant odor.

The iron process never creates a nuisance. This consists in passing the gas through some mixture containing sesquihydrate of iron. The great advantage of this is its cheapness, since the same mixture may be used over and over again. The suphuretted hydrogen in the gas reduces the sesquihydrate of iron, to form water, sulphur, and hydrated sulphide of iron, which last, on exposure to the air, is changed again to sesquihydrate of iron, and more sulphur is set free. This process is adopted very extensively in the European works on account of its economy.

The difference between the action of the lime and that of the iron mixtures appears to be chiefly that, while the lime removes from the gas the impurities which it contains, perhaps better than the iron mixtures, yet, upon the opening of the purifiers, it permits the offensive and noxious sulphurous gases, like sulphide of ammonium, to escape into the atmosphere, become diffused throughout the neighborhood, and act as a nuisance, much more readily than the iron purifier does, which fixes the sulphur by combining with it. So that, where works are situated in thickly settled districts, the principal portion of the noxious constituents of the gas should be removed by wet lime before the gas passes through the dry lime, as in this city, and the "blue billy," as the wet lime residue is called, disposed of in such a manner as not to become a nuisance; or the dry lime should be thoroughly ventilated before the purifying boxes are opened, or recourse should be had to the iron mixtures.

Gas thus made consists chiefly of hydrogen (40–50%), marsh gas (35–45%), carbonic oxide (4½–7½%), olefiant gas and other hydrocarbons (4–8%), and usually very small amounts of carbonic acid and air. Cannel gas has about the same composition, the proportion of the hydrogen, marsh gas, and olefiant gas being a little different.

Gas made from *petroleum* or *naphtha* need not occupy our attention, although it is made quite extensively in many of our large cities for enriching purposes, since when made from Pennsylvania petroleum it contains no sulphur or ammonia, and requires no purification; and I have heard it

stated by those familiar with it that the *pure* petroleum or naphtha gas can be inhaled with as much impunity as nitrous oxide, the symptoms produced being quite similar. By naphtha gas, I do not mean such gas as is made in gasoline machines, but gas made by decomposing the naphtha in heated retorts.

Water Gas. — There is still another variety of gas which is becoming quite rapidly introduced into many smaller towns, and which requires our careful consideration. I refer to the so-called water gas. The theory of the manufacture of this gas differs entirely from that of coal or naphtha gas. It depends, first, upon the production of a non-illuminating gas from steam ; and, secondly, upon the manufacture of petroleum, naphtha, or cannel gas, for the purpose of furnishing the luminants. The great advantage of this process is, that very large volumes of non-luminous combustible gas can be made very cheaply. This is done by passing steam over incandescent carbon, which has a very powerful attraction for oxygen, abstracts it from the steam, and unites with it to form at first a mixture of hydrogen and carbonic acid. The carbonic acid is, on passing through another layer of coal, deprived of one half of its oxygen and carbonic oxide is formed. Thus we have as the result, if the process has been properly conducted, a mixture of hydrogen and carbonic oxide, both of which gases are combustible, but burn with a colorless flame.

In making water gas, anthracite, not bituminous coal, is used, and great care is necessary to keep the temperature up to a white heat, since if it falls too low, a large proportion of carbonic acid is formed, which diminishes the yield of the finished gas, since it must be removed by purification, or if it is not removed, it injures the illuminating power very much. Anthracite coal contains sulphur and yields ammonia when distilled, so that purification is as necessary in the case of water gas as of coal gas. Water gas as thus made contains as a rule about forty to fifty per cent. of hydrogen, thirty to forty per cent. of carbonic oxide, and about ten per cent. of petroleum or naphtha gas.

Strenuous efforts are of course being made by the owners of the various patent processes for making water gas to have it introduced into our large cities, and they advance as one of their strong arguments, the fact that the non-luminous gas alone can be distributed for heating purposes at a cost of only a few cents per thousand feet. But the distribution of this mixture of hydrogen and carbonic oxide alone for heating purposes should be opposed in every possible way, for the reason that, since it is comparatively devoid of odor, its escape from pipes and diffusion through the air of an inhabited room in dangerous amount could not be detected. This mixture contains nearly fifty per cent. of carbonic oxide, which is one of the most active of poisons, producing when inhaled speedy death, and according to Leblanc, "one vol. of it diffused through 100 vols. of air totally unfits it to sustain life ; and it appears that the lamentable accidents which too frequently occur from burning charcoal or coke in braziers and chafing-dishes in close rooms, result from the poisonous effects of the small quantity of carbonic oxide which is produced and escapes combustion, since the amount of carbonic

acid thus diffused through the air is not sufficient in many cases to account for the fatal result."[1]

When it was proposed to supply the *Invalides* in Paris with water gas, a commission was appointed, consisting of Messrs. Dumas, Chevreul, and Regnault, eminent chemists, to investigate it. They found that it contained from thirty to forty per cent. of carbonic oxide and reported "that it would be dangerous to the occupants of the institution to introduce, even by way of experiment, gas obtained from the decomposition of water by the *Kirkham* process."[2] This gas was the odorless carbonic oxide and hydrogen mixture.

H. Letheby says,[3] "Seligue, in 1840, obtained permission to use the gas in the towns of Dijon, Strasburg, Antwerp, and two of the faubourgs of Paris, and Lyons. At Strasburg an accident occurred which put a stop to its use. The gas escaped from the pipes into a baker's shop, and was fatal to several persons; and not long after an aeronaut, named Delcourt, incautiously used the gas for inflating his balloon. He became insensible in the car, and those who approached to render him assistance fainted and fell likewise. The use of the gas has therefore been interdicted on the continent."

It is a somewhat significant fact that, although the manufacture of water gas for illuminating purposes on a large scale has been subjected to investigation, experiment, and trial for more than twenty years in Europe, none of the large European companies have adopted it. It does appear, however, to have been much more successful in this country than in Europe, probably on account of the introduction of petroleum, which affords a cheap and adequate means of enriching it with luminants. Formerly the illuminating power was obtained by introducing into the non-luminous flame, metallic platinum, or by mixing the water gas with rich gas obtained from peat, resin, or some other carboniferous material.

The above remarks in regard to the danger of water gas apply especially, if not only, to the odorless non-luminous gas. The addition to it of petroleum gas very greatly diminishes the danger by imparting to it a very powerful odor, and also dilutes slightly the carbonic oxide. No accidents have, so far as I have been informed, yet occurred in those works in this country where water gas has been manufactured. It is especially against the comparatively odorless gas for heating purposes that we should be upon our guard.

Experimentally, carbonic oxide can be removed by heating to a high temperature in contact with an excess of steam; but that this is accomplished in any of the processes used for making water gas upon a large scale, I am unable to say. This is more likely to be accomplished in what is known as the "Lowe" process (Manayunk) than in any of the others, since an excess of steam passes with the gas from the furnace or generator through a chamber filled with white hot fire-brick called a super-heater or fixer. The carbonic oxide is not destroyed in the "Harkness" process (which was in use in New London, Conn., but which has been discontinued recently on ac-

[1] Bloxam's *Chemistry*, page 118.
[2] *London Journal of Gas Lighting*, June 10, 1856.
[3] *London Journal of Gas Lighting*, May 20, 1862.

count of the high price of petroleum), as more than forty per cent. was found by eudiometric analysis. About thirty per cent. of carbonic oxide was found in the pure water gas made by the "Gwynne-Harris" process, which is now in use in Poughkeepsie, N. Y. Ordinary coal gas has, as I have already mentioned, usually from five to seven per cent. of carbonic oxide.

From a sanitary point of view, therefore, the principal points to be borne in mind, and to be obviated if possible, are : (1) the exposure of the workmen to excessive changes of temperature and violent draughts of air while heated ; (2) to remove from the gas the noxious impurities and those which on burning give rise to noxious products of combustion as completely and thoroughly as possible, and at the same time dispose of the purifying material in such a manner as not to create a nuisance ; and (3) to prevent the introduction of the dangerous inodorous mixture of hydrogen and carbonic oxide for heating purposes. I have dwelt somewhat at length upon this last subject, because the manufacture of water gas appears to be attracting the serious attention of many gas engineers at the present time. and works are now in operation manufacturing from 50,000 to 150,000 cubic feet per day each. The mixture of water gas with cannel or petroleum gas appears, however, practically to be but little if any more dangerous than common coal gas.

SANITARY REQUIREMENTS IN FACTORIES. — INJURIOUS EFFECTS OF COTTON FACTORIES UPON THE HEALTH OF OPERATIVES. — REMEDIES PROPOSED.

By LUCIUS F. C. GARVIN, M. D.

Lonsdale, R. I.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

A brief description of Lonsdale and its factories.
SURGICAL INJURIES.
Statement of the principal causes of the frequent accidents.
Illustrative cases.
REMEDIES PROPOSED.
Legal prohibition of the employment of children.
Careful instruction of inexperienced operatives concerning all places of danger, by those having charge.
Machinery to be cleaned when not in motion.
Gearing to be completely enclosed.
ACUTE DISEASES.
High infant mortality; causes.
CHRONIC DISEASES, such as anæmia, dyspepsia, and phthisis pulmonalis.
Causes peculiar to factory villages.
REMEDIES.
Half-day employment for youth.
Short hours for all.
Improved dwellings for factory operatives.
Better education.
CONCLUSION and a resolution for consideration of the Association.

THE following paper does not claim to arrive at scientifically accurate conclusions concerning the effect upon health of employment in factories. Such an attempt would require more carefully prepared data than are in my possession, and to be complete, would demand a close comparison with similar statistics of other occupations. Its aim is the less ambitious one of putting into plain words certain impressions which are the result of a nine years' medical practice in a factory village, with the hope of their proving suggestive of thought, and, perhaps, of further observations.

About six miles from Providence, R. I., on the banks of the Blackstone River, lies the village of Lonsdale. Like other portions of the valley, the vicinity of Lonsdale, lacking the broad meadows and extended views of the Connecticut, is adapted by nature to manufactures. The older village, in which most of the observations have been made, occupies an irregular triangle, comprising a territory of about half a square mile, with the river on one side and ponds on the others. That portion of this peninsula where the dwellings are located, is forty or fifty feet above the level of the meadows, which in part are cultivated, and in part occupied by the mills, bleachery, dye-house, etc. The dwellings, owned, with scarcely an exception, by the Lonsdale Company, and let to tenants, may be separated into four classes: a small number containing one family only; several long

blocks forming many tenements each; but mainly double cottages; and four tenement blocks. The houses, with few exceptions, are well built and comfortable, are supplied with water in both first and second stories, and are kept as neat as the character of each occupant, under some supervision, will admit. The streets are well shaded by trees, the yards small, — as a rule none at all in front,— the refuse frequently removed; but in places, although disinfectants are used, various ill odors arise in warm weather. The drainage, on the whole, is imperfect, consisting of untrapped pipes conducting either to cesspools, which require frequent cleaning, or to drains which lead to the low grounds. The supply of drinking water, derived from the river, and therefore containing many impurities, is regarded popularly as the source of much sickness.

The mills connected with this village, being the oldest in the vicinity, do not possess all the improvements which render the more recent structures so light and airy. However, they have but few rooms requiring the use of gas by day, and are supplied with machinery of modern construction. In a factory village, where, as in the one I am describing, the entire property is owned by the corporation, very much depends upon the character of the authorities. Their influence may foster morality, education, and health, or may be adverse. Lonsdale has been particularly favored by the rule of a wise and humane superintendent, while the owners, though not themselves residents, have ever shown a more than pecuniary or selfish interest in the welfare and happiness of their employees. Whenever changes have been suggested, by which danger could be lessened, or healthfulness promoted, they have shown a readiness to heed and act.

Surgical Injuries.—Attendance upon machinery unquestionably adds to the number of accidental injuries to which man in every condition, barbaric or civilized, is liable. Each vocation has its own class of accidents. While persons employed upon railroads meet with a large proportion of severe injuries, necessitating amputation of a limb, and frequently loss of life, the accidents of factories fall into the category of minor surgery. While farmers are cut about the legs with scythes, or upon the feet with axes, are impaled upon pitchforks, and subject to a variety of simple fractures of the long bones, the wounds received in cotton mills are peculiar in that their most frequent site, by far, is the hand. Surgical patients, when brought to my office from the mill, usually have one hand done up in bloody cloths, but in the evenings, and almost invariably on Sunday, they come with the head bandaged. As of the latter, the usual indirect occasion is indulgence in intoxicating drinks; so of the former, there is a single predominating cause.

The separate stages in the manufacture of cotton cloth have each a room filled with machinery adapted to a specific purpose. The mules, the looms, the cards, the speeders, etc., are wholly unlike each other in size, shape, and action, but possess, in common, the mechanism, usually some form of gearing, by means of which the various movements are communicated from the central power. Experience shows that these iron cogs, embracing each other so quietly at each revolution of the wheels upon which they are set,

furnish the most prolific source of injury. Catching the side or tip of the operative's finger, without warning, they draw it rapidly in, while, like a hungry shark, the second set, reaching farther on, takes a better hold and again draws in, — the first laceration of the flesh being but a prelude to crushing the bone. The wound produced is, in every case, painful and slow to heal, its severity depending solely upon the degree of rapidity with which the hand can be torn away from the unyielding clutch.

From a list of thirty-six cases of injuries by gearing, occurring during the five years from 1867 to 1872, and recorded at the time, the following facts appear: Nineteen of the patients had one or more bones of the fingers broken, most of which resulted in amputation or a stiff joint, — in either event, a permanent maiming. Few of the cases recovered in less time than a fortnight, a large proportion requiring a full month, and occasionally longer. Although, legally, no person can be employed in the factories of Rhode Island under twelve years of age, it appears from my table that six of the sufferers by gearing ranged from eight to eleven years old. As might be expected from the employment of children whose judgments, like their bodies, are immature, one out of six far exceeds the proportion of illegal to legal employees. Eighteen only of those injured are recorded as adults. A case, not included in the table, illustrates well the greater danger attending youthful workers.

C. E., aged twelve, was injured May 1, 1874. Having had some experience, acquired during his vacation of the previous summer, he had, four days before, at the close of his school term, again begun work. His hand, placed thoughtlessly or ignorantly upon a small lapp or roll of cotton which revolves in a slow and apparently harmless manner, was carried beneath a grooved iron roller which compresses the lapp, and stripped of all the flesh upon its back down to the bone itself. After much suffering, during a treatment of more than three months, entailing a heavy expense upon his widowed mother, he recovered with the member disabled for any but the most clumsy uses.

Inexperienced operatives, or those placed upon a kind of work to which they are unaccustomed, no matter what their age, are specially liable to accidents. Thus, Miss M. C., aged seventeen, on the 21st of August, 1875, when put in attendance upon a new *speeder*, passed her hand for some purpose through a narrow space between the frame and the floor, was caught by the hidden gearing, and lost four fingers. She was wholly unaware, she states, that anything dangerous was there concealed. August 25, 1876, Miss N. M., aged fourteen, recently given the charge of a *speeder*, engaged in cleaning about the gearing while in motion, had the bunch of waste which she held, caught, the hand drawn in, and the little and ring fingers crushed well up into the palm. November 27, 1869, T. D., a young man, lifted the glass door of the picker, which encloses a large roller studded with coarse teeth, for the purpose of removing a wisp of cotton. Although the belting had been thrown off, the cylinder had not yet ceased to revolve, so that his hand was caught and literally chewed up, necessitating amputation above the wrist. He sought to account for his carelessness by saying he was

under the impression that the roller was partitioned off. In the same terrible machine, J. H., on September 15, of the year previous, likewise attempting to remove some cotton, had his hand drawn in by the picker teeth, which crunched the whole limb to near the shoulder joint.

Persons who have spent their lives in factories are not exempt from accident, as appears from the following instance: G. P. C., an overseer of about fifty, who had worked in a cotton mill forty years, on July 22, 1871, when looking in another direction, put his finger into some gearing. Old hands are not often injured by such inadvertence, but usually in consequence of being too venturesome. It is a common thing for them, in order to save time, to do certain repairs, cleaning, etc., while the machinery is in motion, notwithstanding it may be contrary to the rules. In these various ways both employer and employee suffer, the one a pecuniary loss, the other a far more serious misfortune.

The Remedies. — The preventives which are most potent, and especially require notice here, are the four following: —

1. The law, forbidding the employment of children under a certain age in or about manufacturing establishments, should not only be enacted but put in force.

2. Whenever persons, young or old, are first set to work about machinery to which they are unused, the overseer should point out carefully, explicitly, and emphatically the places of danger, so that maiming through sheer ignorance should be made impossible.

3. The cleaning of machinery which is in rapid motion should be prohibited.

4. When possible, as is usually the case with belts and gearing, every source of danger should be completely covered in, so that by no casualty can the fingers or clothing become involved.

The advantage to be derived from the adoption of the fourth means of prevention has been amply shown in Lonsdale, where, year by year, additional gearing has been enclosed, as experience proved necessary, so that, although without statistics to substantiate the statement, I am fully satisfied that within the past nine years the number of injuries from this cause has been reduced by a very large percentage.

Acute Diseases. — With the exception of a single class, observation has not led me to the conclusion that acute diseases are largely influenced by the presence of manufacturing establishments. It is true that in factory villages, owing to the closer contiguity of dwellings, the greater number of occupants in each house, and the semi-diurnal assemblage and dispersal from every family and of all ages at the common places of labor, contagious diseases spread more rapidly and infect more generally than in a farming town of the same population. The one condition of life in which sickness and mortality from acute diseases are increased, is infancy. The proportion of women to men employed in cotton factories being very great, mothers are constantly tempted to leave nursing children in the care of a superannuated relative, while they go to the mill. As a consequence, babes are put, entirely or in part, upon artificial diet, which, especially in summer, is a chief cause

of the alarming infant mortality, — a mortality augmented unquestionably by the poor quality of milk sold in the villages. Mrs. W. G. informs me that she has no living child, two of the three which have been born to her having died with *cholera infantum* at the age of four months. In both cases, owing to her being at work in the mill, recourse was had to artificial diet, the whole procedure falling short but little of indirect murder.

Chronic Diseases. — Chronic diseases are the result, usually, of long continued abuse either of the part immediately involved or of the whole system. Thus catarrh, the most common of them all, seldom or never arises from a single "cold" occurring in a state of health, but has its real *nidus* in a debilitated condition of the victim's system. In such diseases, as a rule, inception and recovery, as indeed their whole course, are gradual and slow. Only by frequent overloading or improper supply of the stomach do repeated indigestions finally pass into a seated dyspepsia. As disorders of this wearing character are the just rebellion of nature against man's folly and fatuity, so the first and longest step towards cure lies in the removal of the cause. In illustration of the manner by which employment in large factories produces chronic disease, I have selected three of the most common and obstinate — anæmia, dyspepsia, and phthisis. Each of these arises from the one cause of imperfect assimilation of food, if that term be held to include both digestion and cuticular absorption. Whether in a given case an insufficient nutrition is to occasion the one or the other disease depends, I think, entirely upon the idiosyncrasy of the individual who may be subjected to its depressing influence.

Anæmia, or poverty of the blood, manifested by paleness of the skin and mucous membranes, is measurably present in a majority of operatives. Like a plant kept in the shade, there is wanting, in persons who for eleven hours a day are in-doors, that hardy tint and firm texture which characterize the more obedient to nature's law of growth and perfection. As a positive malady, however, calling for the services of a physician, anæmia occurs by natural selection before mature life and peculiarly in young girls. Nature's cure consists in out-door exercise, aided by a diet of such ferruginous articles as beefsteak and milk, to the rejection of pastry, tea, and other blood despoilers, — restorative measures which may be assisted but cannot be superseded by drugs. Anæmia, therefore, is frequent and intractable among the young women who form so large a proportion of the operatives of a cotton mill. To induce them to leave the mill for a sufficient length of time to regain health proves a very difficult matter. Girls once employed as operatives have a mania for that occupation, and will rarely consent to exchange it for other kinds of employment. The following is an outline of a not unusual case: Miss A. H., aged about twenty, having become very pale and thin, loathing and at times vomiting food, was advised in April, 1871, to quit work, and take the air for at least four weeks. She obeyed just four days. From that time to September, a period of six months, she was at intervals under my observation, and, although improved somewhat by the administration of tonics, was at no time in enjoyment of health. When seen a year later, her marriage having occurred meantime, she was less anæmic, but far

from being well; and, subsequently, upon the occasion of maternal cares, she was and still continues to be thin, careworn, and sickly in appearance.

The same causes, operating in older persons, are more likely to end in fixed dyspepsia, of which the following is an illustration: W. C., who has spent a large part of his fifty years of life in the weave room, has been troubled with pain in the epigastrium for fifteen years. In October, 1870, he reported his dyspeptic symptoms as, on the whole, getting worse, to the extent even of keeping him awake much at night. His diet then had become reduced to bread, butter, and tea. Potatoes lay like a leaden weight in his stomach, home-brewed beer disagreed, milk acted no better, meat occasioned so great discomfort that after having eaten it, he would seek relief by voluntary emesis. Water-brash, constipation, and, finally, loss of appetite, rendered him miserable. The abandonment of tobacco and treatment by drugs have accomplished nothing more than a mitigation of the more pressing symptoms. Similar cases occur even more frequently in women whose diet becomes limited to bread and tea, the latter of which they consume by the bowlful at every meal, and utterly refuse to relinquish. The sufferers from this form of chronic dyspepsia are almost invariably spare in flesh, and possessed of that anxious expression of countenance peculiar to the overworked.

When there is a tendency to consumption in a family, *that* is developed instead of or in addition to anæmia or dyspepsia.

From the whole number of cases of pulmonary consumption falling under my notice in the five years from 1867 to 1872, sixty-four, or all whose course was traced with a sufficient degree of fullness to make them susceptible of classification, have been selected for tabulation.

With the exception of nine or ten, who pursued other occupations, — mainly natives of Rhode Island resident near Lonsdale, — the table is made up of persons who had been factory operatives, thirty-four of them being so employed when their sickness began. Forty-four were females, twenty males. Forty of the cases, when first seen, were not above thirty years of age, nineteen were older, and five unknown. Thirty were natives of Ireland, five of England, five of Scotland, two of Canada (of French descent), eleven of America, eleven not recorded. Sixteen of the number had a rapid form of phthisis, running its entire course in a year or less, while most of the others were chronic. Death resulted in thirty-eight, or three fifths of all the cases; six only are known to be now comparatively well, leaving twenty who by removal or otherwise have passed out of my knowledge and whose present condition is uncertain.

Perhaps the most striking fact taught by these statistics is the predominance of Irish consumptives over those of other nationalities. Many of the English, whose ancestors for generations have been mill operatives, and who exhibit in their lank and sometimes deformed bodies, what an impediment the employment offers to a healthy and symmetrical physique, persons who would naturally be singled out as scrofulous, are far more apt to be the victims of dyspepsia than of phthisis. On the other hand, plump and fresh-looking young men and women, recently from a farm life in Ireland, fade

away with consumption in their new climate and unwonted occupation. I recall instances of the loss of the younger members of a large family, the father and mother being still alive and well. While such cases rarely recover under the most favorable circumstances, their course seems more rapidly and certainly fatal in females than males, attributable to the greater difficulty — almost impossibility — of making a radical change in their mode of life. Likewise, although anæmia, dyspepsia, and phthisis are only too rife in New England among all classes, it is safe to say that they are more prevalent and less yielding among mill operatives than among those who follow diversified pursuits.

Three leading causes of imperfect nutrition here exist at a maximum, namely, lack of sufficient air, of sunlight, and of circumstances favorable to perfect digestion. As a consequence of the necessity of keeping the workrooms warm, they become in winter very close, even in new mills where an attempt has been made at ventilation. And impure as is the air breathed by day, at night it is often far worse. Small and close sleeping apartments have long been a shame to the intelligence of New England, and a prolific source of the chronic diseases for which she bears an unenviable distinction. What is bad in the construction of houses built and occupied by the owners, has become intensified in the tenement dwellings which are erected with a view to economical letting. A physician called in the night to an attic whose floor space is nearly covered by one, two or three fully occupied beds, is irresistibly impressed upon entering with an inclination to cut the surcharged atmosphere into cubic blocks, and toss them out of the window. It calls to mind the effluvium which arose from the hatchway of ships used for transporting soldiers during the late war.

Light, equally essential with air, enters factories now far more freely than was the case formerly. Economy here coincides so manifestly (as it always does really) with the laws of health that nearly half of every side of the largest rooms is taken up by lofty windows. But, be the building as well lighted as it may, those employed there, during six days of each week, are deprived of out-door exercise by daylight for more than half the year. In Lonsdale, a few years ago, the hours of labor were reduced from sixty-six per week, — the usual number in Rhode Island, — to sixty-three, work ceasing at a quarter past one o'clock every Saturday. As a result the youth devote the afternoon of that day to athletic sports, to the manifest improvement of their physical and mental tone.

Of the entire population of a factory village, that half which labors in the mills rises about six A. M., bolts in five or ten minutes an ill cooked breakfast; at noon has three quarters of an hour to go to and fro and partake of a hasty dinner; and at half-past six in the evening return, to supper, the only meal to which sufficient time is allotted. Little appetite is felt for breakfast; a too hearty dinner with immediate resumption of work is frequently followed by indigestion, leaving supper as the only rational meal of the day. It is proper to state that the rapid eating, as well as the crowded bedrooms, are as much the fault of the people as of their employers. Where the length of nooning would admit of a full half hour at the table, oftentimes no

more than ten minutes are so spent, the remainder of the interim being devoted to smoking or lounging. The putting of more than one bed and two persons in a lodging-room, also arises from a wish on the part of the tenant to add to his income by taking more boarders than the tenement was designed to accommodate.

The remedies appropriate to the state of things here described, and by which the general health, freedom from chronic disease, and average longevity would be promoted, are: First. The employment in factories of the young of both sexes, certainly of those less than sixteen years old, only half of each day. With the exception of earliest childhood, the four years from twelve to sixteen embrace the most critical period of human existence. It decides whether the remainder of life is to be physically comfortable and efficient, as well as whether a sufficient groundwork of education be laid to render its possessor capable of future self-instruction. For a year or two at puberty, the energies of the system are devoted to its own elaboration, and cannot with safety be directed to the accomplishment of much of other work either manual or mental. If the youth of fourteen holds his own with relation to his environment, it is the most that the teacher or parent ought to expect, yet here are factory children, pale and attenuated, amid the buzz of machinery eleven hours per day. Sixteen years is selected as the very earliest age at which it is safe to be confined as many hours as those who have attained mature life, while those who require a year or two longer to pass the perils of puberty, are not few. The practical obstacles which exist to a half-time system are trifling. By putting adults upon such work as is now improperly intrusted to children, two relays of youth can easily be obtained from the large families which abound in factory villages, to perform the lighter duties which are appropriate to them. Factory employment exceeds most other occupations in its demand for workers of diverse age and sex. It is nothing unusual for the father, mother, and every child to have constant occupation in the same cotton-mill, while if the head of the family be a mechanic or laborer, he alone is the recipient of wages. A strong temptation is thus presented to parents, in lieu of sending their boys and girls to school, to keep them continuously at work. The want of economy in the long run of this short-sighted avarice, not being perceived by those who have natural control, it becomes the duty of the State to protect itself, as well as the future health and prosperity of the children, by a legal guarantee of rudimentary education. As has been pointed out, this can be obtained with equal advantage to the employer, in no other way than by two sets of youthful operatives, who shall alternately relieve each other. How well the plan of half-day schools answers for the children themselves, appears from investigations and statistics made in England. In scholarship it is found that as much is learned by those who attend but half of each day, as by those who, according to the old system, are present all the time. Physically the benefit is manifest in the energy and elasticity gained by the varied occupation, and the opportunity afforded for out-door sports, as contrasted with the languid and spiritless condition of those who are confined in the mill all day long.

Secondly. Shortening the hours of labor from fourteen per day, as was the

case fifty years ago, to eleven now, has been a positive gain in every respect. But sixty-six hours per week is too long. An hour's nooning, and a half holiday each week are the least that can be granted to overcome the injurious effects already enumerated. By commencing and ending work as now at six and a half o'clock, operatives would be placed upon the basis of sixty hours, as is already established by custom among laborers and mechanics, and as would obtain in factories were it not that competition between rival owners, — each fearing to run his machinery less time than his neighbor, — acts, in this case, to the disadvantage of the employees. It therefore happens that the only way of securing that uniformity which is earnestly desired by all recipients of wages, and is not detrimental to the capitalist, is, *by law*.

Thirdly. Instead of long blocks swarming with human beings, or even four-tenement houses, without yards, each family should be entirely apart from every other. That this recommendation is not visionary may be learned by a visit to certain recently built factory villages both in Massachusetts and Rhode Island. The proprietors of large factories which are not located in cities, usually possess an abundance of land, whose more liberal apportionment as yards and gardens about the dwellings would do much to reduce the mortality of their villages to a level with that of farming communities, rather than to leave them in this respect upon a par with cities. Separate habitations with larger and better ventilated rooms, by attracting a superior and more permanent class of operatives, would subserve the pecuniary interest of the employer as well as the health and welfare of the employee.

Fourthly. But were every tenement perfected in accordance with the highest taste and latest hygienic science, many of them, when occupied, would speedily be brought to resemble a hog-pen. Although much may be done by favorable outward influences to make a home convenient, wholesome, and inspiring, it still remains true that complete regeneration must spring from within. Mental apathy, impure air, unwholesome food, rapid eating, intemperance, all deteriorating to the general health, are the direct and unavoidable outgrowth of ignorance. The remedy lies in day schools for the young, in evening schools, churches, libraries, lectures, lyceums, and every other instrumentality for promoting general intelligence among all. No coercion, "intimidation," or other undue influence, which easily have birth in the position of dependence held by the operative, should be used to control him in his social or political relations. A sufficient degree of education to furnish a basis for correct reasoning is as essential to the highest health as to liberty of thought and speech.

> "What causes first in English halls combined
> To free the voice? — Those which first freed the mind."

The inspection of factories by one having authority to correct any injury or exposure of the children employed therein, who, in this public capacity, are especially the wards of the State, comes within the power of government, however limited the signification given to that term. It is a common thing for gearing, belts, etc., to be left uncovered where heedlessness or ignorance in those who work about them is continually occasioning accidents. The law which stands upon the statute book of Rhode Island, as of other man-

ufacturing States, forbidding the employment of children under a fixed age, is a dead letter, and will so remain, unless special means are adopted for its execution. For this duty as well as for the inspection of tenements, a local magistrate or officer, who is usually dependent upon the proprietors for his position, has not proved sufficient. In England a government inspector is empowered to bring cases to trial.

In factory villages, owing to the many cases of enforced absence of mothers from their infants twice a day for five or six hours at a time, and the consequent artificial feeding necessitated, the quality of cows' milk sold becomes a matter of at least as much importance as in cities. The detection and punishment of persons guilty of the adulteration are about as unlikely to be effected by the parents as by the infants who are the immediate sufferers. Nor would it be enough for an inspector merely to test samples that are sent to him; but he should be required to make frequent examinations of his own volition.

The objects of the foregoing remarks are summed up in the following resolution: —

Resolved, That the due protection and welfare of operatives demand: 1. Half-day schooling for children under sixteen years of age. 2. Uniform hours of labor, not exceeding sixty per week. 3. Frequent inspection of the mills and tenement dwellings of factory villages, and of the milk sold to the operatives, by an authorized public health officer.

III.

MARINE HYGIENE.

THE SAFETY OF SHIPS AND OF THOSE WHO TRAVEL IN THEM.

By JOHN M. WOODWORTH, M. D.,
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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

The sanitary architecture of the sailors' house afloat.
Inspection and rating of vessels.
Seaworthiness of sailors, their physical condition, food, clothing, and provisions for repair, and necessity for marginal or reserved bodily forces on shipboard.
Provisions for saving life in case of accidents at sea.

Waste of human life is witnessed everywhere. Next to the waste by war, in no field of human activity is it more strikingly illustrated than among the toilers of the sea. Every year brings its measure of disasters on the sea, seemingly with as much regularity as the seasons follow in the march of time. During the year 1875, 1,502 American vessels are reported to have suffered disaster; adding to these the eighty-five casualties to foreign vessels on our shores, gives a total of 1,587. Of this number, 477 vessels collided, and 209 other casualties were admitted to have arisen directly from carelessness or ignorance; 312 vessels, aggregating a tonnage of 102,512 tons, and valued, with their cargoes, at upwards of ten millions of dollars, were wrecks involving a total loss. The number of lives imperilled in these disasters was 20,215, and 888 lives were lost, besides seventy-three persons drowned where no other casualty occurred to the vessel.

One hundred and fifty vessels were reported to the British Board of Trade in the year 1873–74, as not heard from after sailing or being spoken at sea. All of these are supposed to have gone down with the 2,381 persons on board. Including these missing vessels, there were reported to the same authority, in the same year, 6,084 vessels as having suffered wreck, collision, or other casualty, resulting in the total loss of 1,411 vessels, and 6,817 lives. During the ten years ending June 30, 1874, there were 22,098 wrecks, collisions, and other casualties of vessels reported as having occurred on or near the coast of the British Isles alone. Over twenty-five per cent. of this number were total wrecks, involving a loss of over 8,200 lives, and of property to the value of about ninety millions of dollars.

With such a startling array of facts, it is no wonder that the appeal of Samuel Plimsoll has been heard around the world. No thoughtful person will doubt that a large proportion of these casualties were preventable. The losses of vessels result chiefly from the use of unseaworthy vessels ; from lack of the necessary amount of physical force, resulting from short crews and unseaworthy sailors ; from overloading, or from ignorance, inattention, or recklessness of officers. Exact statistics, giving the causes of loss of vessels and life, are only attainable in a small proportion of the total number involved. In the British mercantile service, three fourths of the casualties in 1873-74, are placed under the head, "other casualties," and in the statistics of the United States for 1874-75, three fifths are so classed. In the British service for the year named, — (1) "defects in ships and equipments" is the reported cause of 113 disasters ; (2) "overloading," of eight ; and (3) "carelessness, inattention, or ignorance" is charged with 273 ; while (4) "collisions," — the major portion of which should, without doubt, be charged under the last head, — was the reported cause of 1,537 disasters. In the service of the United States, 20, 3, 101, and 986, stand over against the four last named causes respectively. Overloading is given as the cause of only eleven casualties in an aggregate of 7,671, but most of the vessels that go down from this cause are a part of the long list of those never more heard from after leaving port.

Of United States vessels which suffered casualty in the year 1874-75, 832 were under ten years old ; 478 over ten years and under twenty-five ; 95 over twenty-five and under fifty years, while the age of over eleven per cent. is unknown. Of the 21,109 vessels lost or damaged on or near the coasts of the British Isles, during the nine and a half years ending June 30, 1874, 923 are known to have been over fifty years old, twelve of these being upwards of 100 years, and over ten per cent. of the whole number unknown. Great Britain and its colonies, and the commercial countries of Europe, together with the United States of America, have in the aggregate over 150,000 [1] vessels, with a tonnage of nearly 19,900,000 tons, and manned by an estimated aggregate of over 1,000,000 of sailors. It should be remembered, however, that the number of seamen required to man the vessels does not comprise the total number of sailors. There are probably 1,500,000 seamen belonging to Europe and the United States.

The commercial marine of the United States "represents our distinct nationality in all climes and upon all seas ; an interest that has given more to, and asked less of, the government than any other of similar magnitude ; an interest more essentially American, in the highest and best sense, than any other which falls under the legislative power of the government." [2]

Let us inquire what the government has done and is doing to protect our

[1] The numbers obtained are for different years, — from 1873 to 1875, — and are 152,880 vessels of 19,893,496 tons, and estimated crew of 1,054,374. The exact number of seamen in the United States is not known, but is calculated on the basis of tonnage, and average tonnage to each vessel as compared with the proportion of crew to tonnage in the merchant navy of Great Britain, the number of whose seamen is known.

[2] Letter of the Hon. James G. Blaine.

ships, and those who travel in them. Under the power given by the Constitution of the United States, Congress assumed charge of all aids to navigation by act of August 7, 1789. During the colonial period, light-houses were established at twelve principal points on the Atlantic coast, from Portland, Maine, to Charleston, South Carolina; but under the wise policy adopted and steadily maintained by the government in respect of this service, the number of light-houses and *stake* lights is now 934. There are besides these, 30 light-vessels; 53 fog-signals, operated by steam or hot-air engines; 413 day-beacons, and 2,971 buoys. Twenty-eight small vessels are employed as tenders. Some of the ablest scientific men of our time are employed in perfecting this great system of guides set up on the highways of commerce, and maintained free of expense, not only to our own vessels, but to those of every nationality.

The Light-house Board are now experimenting with an automatic signal-buoy, invented by a citizen of New York, which not only promises to make every dangerous rock "speak for itself," but by different tones, or interrupted blasts of sound, enable the mariner to determine his position in the densest fog or darkest night. With the ordinary groundswell, this buoy has been heard from seven to nine miles. The signal service is of recent application as an aid to commerce. Through a system of signal flags, displayed at our principal ports, it warns the seafarer of approaching storms, and through its instrumentality many disasters are averted.

The Coast Survey began in 1807, when the President was authorized to cause a survey to be taken of the coasts of the United States within twenty leagues of any point of the shores. This service has been conducted with great ability and vigor. It supplies the navigator with correct guides to the actual channels, which in many of our harbors are so changeable as to demand constant watchfulness. The Coast Survey Service has published a "Coast Pilot," which contains, for ready use by the seafaring, a digest of the information laid down on the charts. It is in the approach to the shore that the dangers begin; but thanks to the liberal wisdom of the government in this direction, the captain, through the well directed labors of the Coast Survey, is forewarned and forearmed.

The Life-saving Service of the United States was inaugurated in 1850, but its establishment on its present efficient basis dates from 1871. The life-saving service stations now in operation number 135, with about 965 men employed; and twelve more stations are in process of erection. Since the present organization was begun, in 1871, up to the present year, 281 vessels have been driven ashore upon the line of coast protected by such stations, having on board 3,240 persons, of whom 3,197 were saved, and forty-three were lost.

The revenue vessels of the United States, numbering thirty-four, in addition to protecting the revenue, render efficient service to vessels in distress. Under the act of December 22, 1837, the President annually designates about ten of these vessels to cruise during the inclement and dangerous season, specially prepared to render assistance to distressed mariners; and under these orders they are constantly cruising (not going into port except

when absolutely necessary) from about December 1 to April 1. In the year 1875, 195 vessels in distress were assisted by the revenue vessels, and eighty-one persons saved.

The Marine Hospital Service, though directly concerned in restoring the sick and disabled, could, through its medical officers, ascertain the physical condition of seamen before shipping, and thereby prevent unseaworthy sailors from endangering the safety of vessels as they now do. It is of common occurrence for a vessel starting on a long voyage to find on the first day out, that one, two, or three of the crew are unfit for service. They become a tax upon the vessel, without rendering adequate return. The ship's crew, probably short at the start, or at least limited to the smallest number considered absolutely necessary to man the vessel, become, by the unexpected reduction, overtaxed and overworked, and consequently more or less inattentive to duty. On arriving in a foreign port, if the vessel is so fortunate as to reach a haven, the unseaworthy sailors can claim full pay for the time spent, and the master of the vessel must deposit three months' extra wages with the United States consul for each seaman he discharges. Hundreds of such seamen are returned to the United States from foreign ports every year at the expense of the government. Thus the government and commerce are both unnecessarily taxed, many lives are sacrificed, and property goes to the bottom of the sea from a cause preventable by machinery already existing. The application of the remedy rests with Congress. If put into operation, it would work good to all concerned, especially to the shipping interests. The acknowledged efficiency of the Life-saving Service of this country is, without doubt, enhanced by the physical examination of the members of its *personnel* which is made yearly by a medical officer of the Marine Hospital Service detailed for that purpose.

There remains for consideration in this connection the Steamboat Inspection Service, which is more especially intended to prevent the loss of life on steam vessels. As early as 1838 a law was enacted, growing out of the frequent explosions which occurred on the rivers, where high pressure steam power has almost uniformly been employed. Under this law a system of inspection, both of boilers and hulls of steam vessels, was established, and various safeguards provided, such as requirements in regard to safety-valves, life-boats, signal lights, etc. This statute was further amended March 3, 1843, but it was found defective in its operation. The adoption of more efficient measures, however, did not take place until after the occurrence of a catastrophe unparalleled in the history of steam navigation. One of the largest and most elegantly equipped steamboats on the western rivers exploded all of her boilers on her trial trip at Cincinnati, in 1851, blowing the boat into pieces and killing over two hundred people who were on board, and scattering fragments of their bodies on either shore of the river. Following this horror, a law was enacted August 30, 1852, which continued in force, with slight modifications from time to time, until its repeal by the act of February 28, 1871, which is a codification of all previous laws, embracing additional safeguards which experience has proved to be desirable.

The provisions of this law — which still remains in force — relate to means of preventing and extinguishing fire; the appointment of inspectors of hulls and of boilers, and their qualifications and duties; the construction and material of boilers, their working power and maximum pressure of steam; and finally the qualifications of ships' officers, who are required to be licensed by the local boards of inspectors. This act, like every preceding act, has met with determined and persistent opposition. Before the law had been in force six months, a convention of steamboat men met at Louisville, Kentucky, and resolved that they would use every effort to repeal it. They appointed a committee to frame a new bill, and a tax was levied upon the steamboat tonnage of the country of five cents a ton to effect its passage. The bill passed the House of Representatives, and would have become a law but for the opposition which it met in the Senate at that time, and has met at every subsequent session of that body. No attempt will be made to review this bill, which contains many good suggestions. The chief objection urged against it, and which defeated its passage in the Senate, was the limited accountability of owners of vessels, in case of casualty, under its provisions. Senator Conkling in referring to this bill remarked: "I say that as a law between the public and common carriers it is by itself in the whole history of civilized legislation; there is nothing like it; and if you undertake to apply to railway companies or to steamboat companies the provisions of this bill, you might as well repeal all statutory provisions and remit men to their natural rights."

Some of the provisions of the present law, which the last named bill was intended to change, are doubtless impracticable and should be modified or repealed; in some respects it is defective, and should be amended. The yearly tax of officers (as license fees) seems to be an unnecessary hardship, as fifty or sixty thousand dollars is annually collected in excess of the expenses of the steamboat inspection service, and goes to swell the revenues of the government. It would be better for the government to assume the expense of this whole service, as it has of the others named, except the Marine Hospital Service. Such action would remove much of the objection to its enforcement, which appears to be attended with great difficulty. I will cite but two examples illustrating the failure in this direction. Not quite a year ago the steamship *Pacific*, with 238 souls on board, collided with the ship *Orpheus* off Cape Flattery. The latter, which received the blow on the side, suffered but trifling damage, while the former, striking with her bow, and, so far as can be ascertained, with engines reversed, went to pieces, and every one on board, save two, went to the bottom. Fragments of the *Pacific's* timbers, which floated ashore at Beacon Hill, Rock Bay, and Oak Bay, were reported "affected with dry rot to such an extent that they fell to pieces upon being handled. In one instance a portion of her timber was found with a piece of sound wood bolted to a piece of rotten wood, and the bolt itself quite eaten away with rust."

In an inquest on the body of one of the drowned, a former chief mate of the *Pacific* testified that her reputation was not that of a sound vessel; that "her fastenings and knees could be seen working between decks in the

cabin," that "the house on the upper deck and the bulkhead creaked and moved," and "they were always calking her because she spit the oakum out of her seams." Another witness testified as follows: "The certificates of the steamers are all renewed every year by Captain Waterman [the local government inspector]; he walks through a ship, looks at the fire hose, counts the buckets, and goes away again; at the same time I have seen the fire hose and buckets borrowed from one ship to lend to another that was being inspected. I have seen good boats borrowed for the purpose of inspection, and after the inspection hung upon the wharf under a shed, because hanging on the davits is liable to spoil a good boat, and we got our own boats back again after the inspection while the inspector was down in the cabin getting a champagne lunch." The local government inspector referred to above was charged with the investigation of the disaster! Only a short time before the loss of the *Pacific*, the *Florence*, a ship thirty-five years old, swamped in open sea on the same coast, without any apparent reason except that she was too weak to longer hold together when the weather was a little rough. A prominent citizen of Washington Territory, after referring to these disasters, stated that "a large number of the ocean and river steamers now plying on [that] coast are utterly unsafe, and sure, sooner or later, to betray those who have to travel in them to untimely death."

There is a pressing necessity for more efficient measures to prevent the wreck of these vessels and to check the loss of life. So far as steam vessels are concerned the provisions of the law are ample and only require to be enforced; but as respects the other vessels that make up the bulk of our commercial navy, absolutely nothing is done by the government to eliminate the unseaworthy craft, prevent overloading, or the sending of them to sea with short or unseaworthy crews. The "coasters," and the ships in the foreign trade, may not carry passengers, but they do carry sailors who have as brave and generous men among their number as travel in the cabins of steam vessels; if the latter require the care of the government, the former are no less entitled to its protection.

THE NEED OF SANITARY REFORM IN SHIP-LIFE.

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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

The domestic life of the sailor. The bad hygiene of ship life results from ignorance, the indifference of owners, and negligence of officials.

The efficiency of every vessel depends on : —
The excellence of its *materiel.*
The skill and the acquirements of its *officiel.*
The health and strength of its *personnel.*

This efficiency is more impaired by sickness of the crew than by original deficiency of complement or number.

Many of the essentials of good hygiene readily obtainable on shore, not possible on board ship. Consequent greater necessity for providing every possible sanitary safeguard.

Maritime Hygiene of to-day, less deplorable than that of fifty years ago; scurvy and dysentery banished, but pulmonary consumption and rheumatism still fearfully prevalent — the latter due to *foul air and dampness* — the greatest enemies the seafarer encounters.

Ships of which the hygiene is bad, carry about a deleterious atmosphere, contaminating those who breathe it, and serving as a medium for the transportation of disease. Ships not only carriers but originators of disease. Artificial marshes are formed in ships' bilges.

THE conditions of the humble seafarer's life are a profound mystery to the people who live on shore. Even those who make occasional voyages on board passenger steamships, learn very little about the internal economy of their temporary homes, beyond the two or three sumptuously furnished apartments which they themselves occupy. A still smaller number, on gala-days or other special occasions, are paraded over the show-places of a man-of-war, and expected to admire the whitened decks, the glistening brass work, and the polished tins of the mess-kits. Scarcely any one ever sees "poor Jack" really at home. The "fo'c'sle" of the merchant vessel is shunned alike by passenger, owner, and officer, while the naval executive carefully peers into every corner and at every thing, save these, at which his medical colleague points. Ignorance of the passengers, indifference of the ship-owner, and negligence of the officer widen the gulf between the sailor and his social superiors. In the navy, notwithstanding the government commissions a corps of trained men, carefully selected from the best qualified of their profession, ignorance, indifference, and negligence (here amounting to actual neglect of duty), conspire to cover up and out of sight what the medical officer so ineffectually labors to expose. Special causes have contributed to this result. An unworthy antagonism between the so-called line and staff divisions of the service, based upon traditions of different official and social importance inherited from the British prototype, and encouraged by puerile jealousies, and culpable misunderstanding of duties and obligations, have retarded the labors of naval medical officers in the cause of sanitary reform on ship-board. From them and their army *confrères*, more than from any other members of their profession, are

to be expected the proofs of the value of sanitary dogmas. They have accomplished something, and are not to be blamed that more has not been done; but when their lips could not be sealed, their warnings have not been listened to, or have been heard unheeded, and their hands have been tied, when they would have pointed out the way to go, — a way so broad and straight and bright that any might follow it without a guide. The truths of sanitary science are self-evident; nevertheless, they are defied on board ship as on shore, where individuals may claim the right to dispose of themselves as they see fit, and only when this personal squandering of health entails evil to communities, is enlightened administration forced to interfere. At sea there is no such limitation. The individual is lost in the community of which he is a member; he is only one mesh in the net; one cog in a complex machine. The public good is always paramount; and naval medical officers are free from the temptation of the general practitioner, who, in view of eventual profit, may reconcile himself to look with some complacency upon his fellows' determined wanderings in unwholesome by-ways. A sickly season brings no grist to the naval surgeon's mill, but only unnecessary, unremunerative toil. He deals solely with a body of exceptionally healthy, hardy men, and he is independent of, and indifferent to, the whims and prejudices and superstitions of his charges. He is, therefore, free to exercise the higher and more attractive function of his calling, — that of piloting the human bark, freighted with health and hope, safely down the stream of life to the haven of a happy old age, steering it clear of the hidden shallows of disease, and the bold headlands whither it is drifted by the treacherous currents of self-indulgence. Were he recognized as such a pilot, his advice heeded and his work unhindered, the medical returns of the navy and merchant service would soon become sanitary charts of inestimable value to every one whose vocation is to live upon the sea, for naval hygiene is essentially marine or maritime hygiene. The conditions are practically the same — the congregation of a number of individuals in a floating, transportable habitation, required to be of a peculiar structure for speed and safety, which structure is inconsistent with many of the essentials of good hygiene readily attainable on shore; with rregular opportunities for receiving supplies of food and water; experiencing uncertain changes of season and climate; and subject to morbid mental and emotional states, induced by separation from home, disappointment, despondency, or sense of degradation. These are morbific influences, inoperative altogether, or in a less degree, on shore. To render them as little pernicious as possible, the sick and feeble, and those predisposed to disease, should be rigidly excluded from the community by careful preliminary examination. Manifestly, the efficiency of every vessel, whether she be a carrier of freight or of passengers or of munitions of war, and consequently, the efficiency of that service of which she is a part, depends: (1.) On the excellence of its *materiel;* (2.) On the skill and acquirements of its *officiel;* and (3.) On the health and strength of its *personnel.* The most formidable iron-clad, and the most improved artillery, though controlled by the most enlightened officers, are altogether useless and powerless, unless they have vigorous, able-bodied men to maneuver them. The ponderous en-

gines, which drive the steamship fleetly through the water, stand still if the arm of the humble stoker be weakened by fever, and the armored leviathan, bristling with guns, dare not move, if the eye of her lookout be glazed by death. "An army in hospital," says Sir Ranald Martin, "as at Walcheren, at Rangoon, and in the Crimea, — what availeth it to the statesman or the commander?" A frigate, crowded with guns and officers and men, with the yellow pennant at her fore, as at Key West, — what availeth she as an arm of her country's defense, or as a menace to that country's foes?

To provide this personal element of an effective service is the function of the medical corps. It is charged with the primary selection of both officers and men, and with the rigid exclusion of all who are unfitted for its severest exigencies by actual sickness, acute or chronic, by bodily deformity or professional inaptitude, or by constitutional taint, infirmity, predisposition, or inheritance, physical or mental. This duty is usually performed with little hindrance or interference; but when the physician on board ship attempts to say what these men shall do and what not do, in order to continue well and vigorous, he is checked, and told to confine himself to his "pills" (his opprobrious *sobriquet*), to cure men when they get ill, to give advice only when it is asked, and generally to keep himself in the dim twilight or darker night of official inactivity. With the same ignorance of their own interests and of their medical colleagues' legitimate offices, as that of the civilian who grumbles at paying the physician's fee, who has not prescribed a potion, or who resents his medical adviser's charge to amend his habits, the executive authorities on board ship persist in adhering to "the customs of the service," despite their unhealthfulness, and prefer to stumble blindly in the dark, rather than be led by those whose duty it is to enlighten them. Contributing to this is the dread, lest the medical officer will, by ever so little a semblance of authority, encroach upon their own sacred and exclusive domain, and get to fancy himself something more than an humble subordinate of the barber or bone-setting caste. Undoubtedly, to medical men, it will seem absurd that any enlightened physician can be suspected of such treason to his profession as to envy the honors or ape the authority of any other. Undoubtedly our fraternity would have little pride in the fellowship of one who could think to magnify his calling by borrowed consequence, but it is peculiarly the lot of the followers of our noble profession to be misunderstood. Although its science embraces the philosophy of existence, and therefore treats of problems which should most interest every human being, its plainest facts continue occult mysteries to the multitude; and any vulgar charlatan, to-day *Regina del Cin*, to-morrow the *Zouave Joseph*, commands as large and as respectable an audience as those learned masters at whose feet we are satisfied to be attentive, grateful students. The medical officers of the navy, despite personal indignities and official discourtesies, have, therefore, hardly reason to complain that the good work they have at heart lacks so much of completion; but they really have much cause for mutual gratulation that the naval hygiene of to-day is not so sad and doleful a record as it was fifty years ago. It would be ungenerous and unjust not to acknowledge the steady growth of a more liberal and enlightened

spirit among our colleagues in the other departments of the service. The able men, who have for some years administered the several naval bureaus, have shown themselves so alive to the real interests of the service that propositions for sanitary reform are listened to, and sometimes adopted. Scurvy and the sweat-box have gone the way of the cat, the bucking-stick, and the gag. The brute of the forecastle, once lower in the social scale than the plantation negro, who spoke no other tongue than a polyglot jargon, accented with curses and obscenity; who knew no ties of kinship nor of country; who experienced no comfort, and expected nothing but cruelty; who lived a life of which the only romance was its vileness, has been transformed into a human being, who has been taught something, who is somewhat cared for, who is usually well clothed and well fed, but whom it still remains to see well housed, to make him the peer of the mechanic on shore. If much remains undone, we must take into account the radical changes that have been necessary, and not ignore the obstacles to further progress yet to be surmounted. I have, therefore, come before this Association in the hope that its influence may be actively lent toward the official indorsement of these measures of sanitary reform, which medical officers of our own, in common with those of every other navy, are seeking to accomplish, as well in the merchant service as in the national marine of their several countries.

Dr. A. B. Judson, of the Metropolitan Board of Health, and Dr. Heber Smith, of the Marine Hospital Service, formerly our valued colleagues in the navy, have forcibly directed public attention to the beastly condition of the forecastles of merchant vessels, which the latter terms "*the* neglected point of sanitary police." Instances of the apartment in question, selected from the largest passenger steamships and emigrant vessels, are described as "very dark and damp;" "wet from leaky decks, and slippery with filth;" "the air close, offensive, charged with ammoniacal odors;" "light and air admitted by a companion-hatch thirty inches square, and by two nine-inch air-ports, closed at sea;" "approached by a narrow and circuitous passage by stooping under a portion of the anchor machinery, light and air in this case only admitted by the passage of entrance;" "exposed to the further annoyance and offense of proximity to the passengers' water-closets." The berth-deck of the man-of-war is outwardly clean. The rolled-up hammocks are of spotless whiteness; but follow the crew below some time when these hammocks are piped down. Stand by this man as he unlashes his spotless white burden, and spreads out blankets that are as spotless of white. Very likely your hand will involuntarily seek your nose and the saliva fill your mouth, charged with the poison its sister sense resents. Wait, if you can, till the deck is crowded with these hammocks, — if all hands are below, they will hang only *fourteen inches* apart, — and then, if you can still breathe, wait until the crew — in port both watches — are all wedged into place, some scarcely removing their wet and soiled outer clothing, none disturbing the under-clothing, which may have been worn for weeks, and if removed, would disclose, as only the medical officers and their subordinates know, bodies as begrimed as the garments. You will be glad to escape from the fast stifling atmosphere; but return four hours later, just before the relief is

called, or simply stand over the fore or main hatch, or near a berth-deck ventilator, should there be such an apparatus, and the first inspiration will probably choke, and certainly nauseate you by its horrible human effluvium. The forecastle of the merchant ship is unclean, its decks slippery with filth, its paint-work black; but eight or ten, or twenty at most, live there. The berth-deck of the man-of-war is clean, as far as squilgees, and swabs, and water can make it clean to the inspecting officer's eye, when he visits it in the morning, and all the pots and pans are deftly piled; but there lurks in its air at night, when pots and pans and whitened decks cannot be seen, a more insidious, hideous soiler than bits of yarn or spots of grease, — one that squilgees and swabs and water will not remove; one that needs only water and warmth together to enliven it into fiercer activity. Unfortunately this poison of ochlesis does not kill quickly. It is no beast of prey, which rends to sudden death, but, vampire-like, it slowly saps the life-blood of its victims till they sleep beyond awaking. Unfortunately this is so, because its invisible garb and stealthy step prevent its recognition, and cause it to be undreaded. Men live on throughout a cruise, recovering a little by day, through their work in the open air on deck, from their baneful sleep at night; or they break down, one after another, some dying, most of them being invalided, and sent to hospitals with phthisis or rheumatism, or some other malady attributed to climatic influence or vicissitudes of weather, or, in the absence of evident exposure, to undiscovered constitutional taint or preëxistent infirmity. According to Parkes, the extraordinary amount of consumption which prevails in the royal and merchant navies, and which in some British men-of-war has amounted to a veritable epidemic, is undoubtedly attributable to faulty ventilation; and I am satisfied that many a poor fellow has been discharged from our own naval and marine hospitals with fatal pulmonary disease — and refused a pension on the ground that no evidence existed of any exposure in the line of duty, and that the disease was probably, therefore, an inheritance, — who might have lived to robust old age, but for the poisoned air he breathed on board ship, which honeycombed his system, and left him unable to sustain its most trifling disturbance. The average of sailors' sea-going lives is estimated at less than twelve years; and the records of the Marine Hospital service show that during this period over two hundred thousand American seamen die, or are physically disabled from pursuing their vocation, — an average of seventeen thousand per annum; "the result," says the supervising surgeon-general, "of the food the sailor eats, the clothes he wears, the hole he sleeps in, and the excesses these conditions naturally and inevitably drive him to. Is it any wonder, then, that there is a scarcity of efficient seamen, that vessels every day leave port short-handed, and that shipwreck and loss of life grow more frequent year by year?"[1] Bad air and watery vapor are the direst foes which menace the seafarer. Leagued together, they are greatly more to be feared by him than the atmosphere of the most sickly climate, or the boundless waters which environ him. How to keep out water and how to get in air are the two great problems of marine sanitary science, whether referable to

[1] Heber Smith.

man-of-war, army transport, passenger ship, or trading vessel. Naturally the man-of-war should be the exemplar for all the others, and to it we ought to look for the earliest practical application of the teachings of experience and the revelations of science; but just as patent blocks and capstans were long excluded from the navy because there was a surplus of muscle to toil and tug, so there is an indifference to the methods of preserving health, because it is so much more easy to supply new material than to care for that on hand. The executive of the man-of-war, moreover, and, to a certain extent, the mate of the merchant ship, is possessed of but one idea, — how to keep his ship clean, — and to this all else gives way. As his vocation is chiefly peaceful, he occupies himself in polishing the guns for which he has no use, and whitening the decks threatened by no stain of blood. When the hour of battle does arrive, he doffs his epaulettes, and fights bravely enough in flannel, the powder marks remain as honorable scars, and the crew watch or rest, without risk of cold or ache, on the dry sanded decks. All over, heedless of the powerful enemy lurking by his side, he begins to clean, and clean, and clean, ignorant that his very method of cleaning is only a method of soiling, more perilous to health than the spots and stains he seeks to remove. For years, naval medical officers of every nationality have preached, implored, warned, and threatened, in vain, of the danger attending the inconsiderate wetting of the decks. At one time this practice became so bad, that every wretched little schooner and tug-boat, which flew a pennant as the symbol of a naval command, had to be deluged with water, every day of the year, at all seasons, in all weathers, and at all places, simply because that was the custom on board a full-fledged frigate, where not only spar-deck but gun-deck, berth-deck, and orlop were inundated, until the hygrometric condition of the atmosphere was raised to saturation, — a state of things by which the operation of the morbific influences of over-crowding, climatic causes, and vicissitudes of weather is greatly facilitated. What medical officer of twenty years' experience can recall without a heartache the wearying hopeless warfare in which he has had to engage on almost every vessel on board which he has served! Unanimous and persevering, something was gained when the practice of coating berth-decks with shellac was established; but only a few years ago a general order again prohibited this very procedure, than which I knew no greater reform accomplished by sanitary science in the domestic circumstances of life on board ship. Fortunately the wisdom of this measure asserted itself, until it became once more a matter of regulation; and the last ship to which I was attached, and one which I visited still later, were both treated in this way, and not a voice was heard in condemnation. The lower decks, those of sleeping and other apartments occupied as living places, in every class of vessel, should always be covered with shellac, and when cleaned, this operation being rendered as seldom necessary as possible by the careful avoidance of all causes of uncleanliness, it should be done expeditiously with hot water, mops, and brushes, as the housemaid scrubs the kitchen floor. Water, in quantity, should never be allowed to flow into a vessel; but decks exposed to the weather, gun-decks, orlops, and holds, in which unclean work is habit-

ually performed, should be sanded, or covered with tarpaulins during this work, wetted only when weather and place are propitious, and simply scraped and re-sanded at all other times. Should the mariner of the future, centuries hence, discover some abandoned "holy-stone," which has outlived history, he will store it among the stone weapons and utensils of our remote ancestors, and wonder what manner of use they could have made of it.

Improved methods of ventilation also materially assist in keeping ships clean by removing the impalpable debris and dust, which in time settle and accumulate in perceptible quantities; but ventilation which not only cleans but dries, purifies, and vivifies, which is as vitally important to the ship's inhabitant as the oakum calking and copper fastening are to the ship, and which, therefore, ought to command the profound study of every one concerned in nautical construction, is probably the last matter to which a thought is ever given. It is comparatively easy to keep water out, but unfortunately, what keeps out water, often also excludes air. In passenger steamships, where the motive power is always in operation, ventilation is not a difficult problem, while comfortable state-rooms and short voyages render the health risk of the passenger extremely slight; nor is there any reason why the forecastle in such vessels, which the crew may occupy continuously for months or years, should not be just as perfectly ventilated. The best merchant ships now have capacious houses on deck for the officers, with windows opening on the gang-ways, rendering artificial respiration unnecessary; nor is there any reason here, why another house amidships and no less commodious, should not be provided for the crew. Under the top-gallant forecastle, where there is such, there is never sufficient space, and it is, moreover, necessarily so encroached upon by the cables and their adjuncts, that it ought never to be used as a location for quarters, while the forecastle proper below deck, into which one man at a time can crawl through a narrow scuttle, without other entrance for light or air, and which is, therefore, ventilated as a bottle might be through its neck; — this, once the only place assigned to the crew (and still generally so), which they share with the rats and vermin and noisome odors of the cargo, which was never cleaned and never visited by master, mate, or owner, and whence, when he had recovered from the blow of the belaying-pin, which had sent him senseless to the bottom, the mutineer seeking revenge has so often crawled; — this vile stifling hole, both the cradle and the coffin of the sailor, ought never more to disgrace the ships of any nation which boasts its civilization, or where religion teaches that all men — those in flannel and those in broadcloth; those before the mast and those on cabin lounges — are brothers in this world and peers in the next. And here let me remark that the enlightenment of even this day can find no better place for the sick on board an American man-of-war than this same location at the extreme forward end of the vessel, — it is true with a few round air-ports in its sides, habitually closed at sea, in addition to the hatchway overhead and an entrance through an after bulkhead, by which it is fed, as shown by the experiments of Lieutenant J. F. Meigs, U. S. N., and Dr. Howard Smith, with from three to six times the quantity of carbonic acid gas which air can contain to be respirable; disturbed like

its analogue on the merchant ship by the noise of the cables in coming to anchor and getting under way; its atmosphere not unusually befouled by leaking water-closet pipes leading through it, or by bilge ventilators or store-room scuttles opening into it; always dismal and dark;—while he who has become ill in his country's service, despite the care to keep him well, should be bathed in light and air, and sheltered as far as possible from the sounds and smells and gloom of the berth-deck. In many of the ships of foreign navies, the hospital has a location aft and amidships, or forward on the gun-deck above the hawse-pipes, with spacious gun-ports that may remain open at sea; and practically the sick in our own service, who require it, are always given accommodation on gun-decks, or wherever they can best be treated, —even the cabin having been more than once generously surrendered to me for this purpose; but the specially allotted, recognized place for them, is still where it was fifty years ago, and where the admiral of the navy and other officers of advanced views sustain the medical department in maintaining it ought to be no longer. How little is thought of sanitary safeguards, even by the government in the construction of its vessels, was seen as late as 1873, during the naval rendezvous at Key West, when the appearance of spotted fever on board the frigate *Colorado*, in consequence of which she was totally disabled and withdrawn from service, on the very eve of hostilities, suggested a sanitary examination, which revealed a system of discharging the foul air of the bilges, by a series of openings, covered by perforated plates, running the whole length of both sides of the berth-deck, behind the mess-chests and clothes' racks of the men, and in the state-rooms under the bunks of the officers. Human ingenuity could hardly devise a more effectual way of poisoning the atmosphere of a deck, at all times the most difficult to keep pure; and yet this same arrangement was discovered on board the *Franklin*, the largest and finest of our national vessels, and now the flagship of our European squadron, where she represents the flower of the American navy side by side of the ships of every other great maritime power. I am announcing no recent discovery of my own. Medical inspecting officers have proclaimed these things for years, but so little do their proclaimings avail that I am told by the executive officer of one of our latest built ships that the same atrocious system had been there introduced. When the carpenter of the *Franklin*, himself a shipwright of merit and the son of a distinguished constructor, was recovering from what had been almost a fatal attack of low fever, attributable to this cause, he was one of the loudest in denouncing it, and explained how readily these ventilating passages might have been made to discharge into the open air of the spar-deck. Are not they who go to sea, then, almost pardonable in wishing that every constructor, who now, like the school-boy, only watches from the banks the thing he has made to float, might have a similar schooling? Professor Walker, in a recent publication, demands that the State shall see that the common air and common water, which no individual vigilance can protect, yet on which depend the public health and the labor power of populations, in a degree which few even of intelligent persons comprehend, are kept pure; but how much more ought the State to see that the common air and

common water are kept pure in its own especial *demesne*, where the public health and labor power are so essential to its prosperity? The water question has been satisfactorily settled as regards men-of-war. Not a gallon for drinking is now taken on board without the approval of a medical officer, who henceforth has to assume the responsibility of its potableness; but it required a display — little short of charlatanry — of cloudy precipitates and dense deposits — the greater the cloud the more imposing being the effect — to bring this to pass, and confute the belief that danger could not lurk in the liquid if it were clear. As a consequence, scurvy and dysentery no longer disgrace our medical returns; but how near they stand outside the door, ready to reënter, was shown by several comparatively recent instances, where the imprudent continuance of the salt ration, with diminished allowance of water, and that impure, developed unmistakable evidences of the scorbutic tendency. The impurities of the air cannot be demonstrated through cloudy precipitates to alarmed observers, and its abnormal constituents may only be expressed by lengthy decimals, but nevertheless the public health and public strength respond to them with barometric precision. Scurvy has been driven away, but pulmonary consumption, ghoul-like, feeds upon its victims in undisturbed security.

No medical officer is unreasonable enough to insist that a ship can ever be made so comfortable and healthful a living-place as the home on land. Neither can the sailor hope to enjoy the comforts and pleasant surroundings of the officers. In a necessarily circumscribed space, a greater or less number of individuals of humble station have to live, and the effort can only be made to diminish this number to its smallest limit, and to provide for these every safeguard that sanitary science can suggest. The laborer before the mast has no more claim to the nine or ten thousand cubic feet of the admiral's quarters, nor to the three or four thousand of the captain's cabin, than has the laborer on shore to the ease and luxury of the merchant's drawing-room; but he has the same claim as the latter to an unstinted share of that light and air and water, which are their common inheritance during life, as an equal space in the bosom of the earth is to be theirs when this is done. There are few ships in the service, in which officers' state-rooms measure as much as three hundred cubic feet; and, confined as is this space, it is further restricted by cumbrous furniture of ancient pattern, by clothing, books, and bedding, and by the accumulated purchases of a cruise, while impervious bulkheads shut out fresh air, often leaving no other source of supply than through the doorway. Sometimes the single small air-port is open, but I have known many officers, through fear of a reputed unwholesome climate, or of a draft, which the average American dreads worse than foul air, keep this shut, whilst their doors would also be closed, or shielded by thick curtains; and two or more lighted candles, each to the extent of a human being, would be doing their share toward consuming, what Condorcet well termed, the "vital air," their dull flames attesting its impoverishment by flickering dimness, not to be brightened by any increase in their number. The lagging fire of the engine's furnace is freely fed with oxygen, that combustion may go on and work be accomplished, while it is denied the human

furnace, with a like need for that same oxygen, without which its combustion ceases and its work stops. The iron worker stubbornly stands still, but the mind-endowed worker of flesh and blood is made to struggle on, using his own substance to feed his hungry fires. What wonder that, in looking back twenty years, so many of us find ourselves the sole survivors of a mess. There was a great deal of drunkenness in the old navy, is the whispered suggestion. Alas, how many of these drunkards were driven by the imperious cravings of their bodies to that artificial stimulus to activity, which was the credited, but only the indirect cause of their destruction.

If the officer is on short rations of oxygen, what must be thought of the sailor, with his less than a hundred cubic feet of air? The official reports to the Navy Department for 1873 and 1874 show, that while on board frigates of the *Franklin* and *Wabash* class, each man had from 125 to 175 cubic feet, the cubic air space for each individual aboard the smaller vessels was only, on the *Shenandoah*, 96, *Monocacy*, 95.35, *Saco*, 90, *Omaha*, 80, *Wyoming*, 89, *Wachusett*, 88, *Hartford*, 87, *Kearsarge*, 81, *Iroquois*, 80, and *Kansas*, 60; the worst of all being the *Juniata*, which, in 1874, gave only 55 cubic feet per man, with no less than *twenty-nine* of the crew reported as with "no sleeping billets." Was it strange that she was found not to serve the purpose as an apprentice ship? Authorities agree that not less than twenty cubic feet of fresh air per minute are imperatively demanded by the healthy organism. When the same authorities declare that not less than thirty ounces of food are required by that same organism, purveyors make haste to provide it, and, in our navy, actually supply it in excess; but the demand for air is not listened to, or is treated with contempt. The night wind from the marsh is carefully and timorously shunned on shore by the same individual, who ridicules his medical associate's declaration that he is generating with all his might a malarial atmosphere around him, by hoarding up carbonic acid in excess, and adding watery vapor in large quantity to the carburetted hydrogen and the ammonia and the other gases which the coal abundantly supplies, and thus furnishing the very food the miasmatic germ requires to develop it into virulence. He scoffs at the warning to beware of wet decks, and lights charcoal fires and generates steam to dry them, ignorant that as the temperature rises, the capacity for retaining aqueous vapor in solution is proportionally increased. With pitiable self-confidence, he quietly sleeps on the bed he has made, breathes over and over invisible seeds of disease, storing them away in his lungs, to be some day ripened into destructive activity. Many an officer in the navy, who has come from a cruise with a cankering cough he is never to lose, and has racked his memory to recall some cold he caught on deck, or some draft he sat in below, who has boasted his chest development, the very expansiveness of which I have come to believe may have invited its destruction, and who has wondered why he should suffer since none of his family have been consumptive, got his death-wound in the close bulk-headed and curtained room he occupied, where he breathed over and over an atmosphere vitiated by his own exhalations and those of his frequent visitors, by the constantly burning candles, by the foul discharges from the bilge, by the living

odors of a neighboring pantry, and possibly by a private stock of perishable food imprudently stored behind his bunk. Only the medical returns, in their well-filled columns of "diseases of the respiratory organs," attest how many fall in this battle with nature's laws. Four parts of carbon dioxide in ten thousand represent the normal constitution of the atmosphere; six parts are obnoxious to health; but a series of accurate observations on board the U. S. steamer *Omaha*, by Dr. Howard Smith and Lieutenant J. F. Meigs, discovered in the atmosphere of the forward part of the berth-deck, just abaft the sick-bay bulkhead, during several successive mid-watches, the frightful excess of from *eighteen* to *thirty-four* parts in ten thousand; under the top-gallant forecastle, during another middle watch, twenty-seven parts; and in that open area of the ward-room, styled "the country," the officers' assembly room, one night at sea, 22.7 parts, — this at 9.30 P. M., the hour when the apartment was most occupied, and when, the report further particularizes, there were "several candles and two lamps burning, and all sky-lights but one, and all air-ports closed." These figures tell their own tale. They need no word of comment.

While it is true that the cubic air space cannot be largely increased, improved methods of ventilation will greatly augment the supply of fresh air and the removal of the products of respiration, which go to form or feed that mysterious "disease dust," that settles everywhere with such deadly effect. Every stagnant pool of air should be set free; every corner and culde-sac where it can settle should have its vent; every bulkhead should be perforated above and below, that the currents may have full sweep from end to end of the vessel; continuous air-passages should course everywhere, around magazines and store-rooms, encircling and permeating stores and provisions, for Endemann has shown that dilution and motion are detrimental to *bacterial* development. Ventilators operated by hand or steam — and the system of exhaust fans, proposed by Passed Assistant Engineer Baird, can hardly be improved — should be constantly at work; and the same jealous and zealous care with which the lifting-leech of the sail is conned, should be given to setting and trimming wind-sails, opening air-ports and scuttles, and furling awnings and hatch-covers, to let in floods of light and air, and their inseparable handmaids, health, strength, and life.

Good hygienic conditions which maintain a few in health ought all the more to be established, since experience has demonstrated that a permanent sick-list of ten per cent. is a far greater cause of inefficiency than an original deficit of twice as many in the complement. The absence of twenty or thirty individuals augments the air-space, which the presence of an equal number of sick diminishes and deteriorates, while the care these demand, in the name of humanity, interferes with the regular routine of duty. The lessened efficiency of our ships and the expense attending the invaliding, hospital care, and pensioning of disabled men, and the enlistment and instruction of raw recruits to supply their places, are practical exponents of the evils of neglected hygiene, when the mere loss of life, however humble, is not considered of account. But the lives lost are not always humble, for shipwreck comes to both bow and stern, drowning alike the rats of the forecastle and

the sleek pets of the cabin; and there is a time when the fever-fiend leaves his lair and silences the voice of command on the quarter-deck as he had already stilled the voice of obedience before the mast. Preventable mortality, says Odronaux, is criminal mortality. Disease is the opprobrium of the physician — the sign that he has failed, — culpably if he has been silent when he should have fearlessly spoken, — in his divine mission to banish suffering from the world and secure to every human being that happiness which alone springs from perfect health. The time has come when ignorance of the laws of living shall no longer be the plea for their violation, when responsibility must be unmistakably fixed and fully exacted.

Personal cleanliness, proper clothing, suitable bedding, good food, and pure water, are all as necessary to the health of the individual on board ship as on shore, but there the interest of the community being greater, they cannot be left to individual discretion, but ought to demand the constant supervision and authority of the officers of both merchant and naval services. In the latter, while hammocks are scrubbed often enough and outer clothing washed, it is but seldom that blankets and mattresses are cleaned and aired; and certain undergarments may be worn unchanged for months, a neglect all the more indefensible, since the custom is general of compelling the watches to occupy each other's hammocks, the clean and healthy having, perhaps, to sleep within some other's soiled and repulsive bedding, or in time surrender their own dry blankets to a drenched, diseased, or dirty relief.

But it is not possible within the limits of this paper to discuss the minor points of the hygiene of ship-life. I have only sought to show that this Association in its concern for the Public Health, ought to inquire authoritatively into what can be done by government to lessen the liability to disease by instituting regulations for the better sanitation of men-of-war, passenger, and merchant vessels. The ship, of which the hygiene is bad, carries about a deleterious atmosphere, which not only contaminates those who breathe it, but is a medium for the transportation of disease. Great obstruction to commerce and great inconvenience to passengers and merchants, are the results of the frivolous quarantines of Spanish, Portuguese, and Levantine ports, which condemn to protracted isolation vessels that have communicated with places where disease had or might have prevailed; but a quarantine which would put the ban upon every unclean vessel, no matter whence she came or whither she was going, which would require a sanitary inspection of every vessel arriving or about to sail, whether line-of-battle ship or coasting schooner, passenger steamship or fishing smack, China clipper or canal boat, with respect to the location, dimensions, and condition of quarters, the appliances for ventilation, the suitableness and cleanliness of bedding and clothing, and the supply and character of food and water, as well as the personal healthfulness of crews and passengers; which would not only exclude disease material, but bring to punishment disease mongers, which would empty hospitals, reduce pension lists, and diminish death-rates, — such a quarantine would be an honor to the nation, and a boon to humanity in its saving of the needless waste of human health and life.

Note, p. 97. — In the compression of chapters in this division of the volume a few sentences were omitted from this page of Dr. Gihon's paper which are deemed important to be read in their place.

After the word *destroyer*, at end of first paragraph, read, —

; or if we stand with averted eyes, while other enlightened nations are hedging it in so satisfactorily by the sanitary inspection of abandoned women, shall we not at least take care that the men, whose slaves these wretched women are, shall not add bodily pollution to moral staining, and magnify their iniquity by making them disseminators of irreparable hurt to sisters who have not sinned, and to innocents yet unborn?

And, at end of second paragraph, read, after the word *heaven*, —

Let her carry it to a latitude where the temperature is high, and then soak the spongy decks until the atmosphere is so saturated with the vapor of water that the fall of a single degree will precipitate it in a miniature rain, and it will not be long before the death-roll is called, and those who most disdained the physician's warning, will be first and loudest in appealing to him for help.

There is one other scourge of the human race, which is carried from port to port, and country to country, by means of ships, and which with pulmonary consumption and rheumatism is among the prominent facts to-day in the health history of the sea, and which, equally with them, commands the marine sanitarian's thoughtful attention, — venereal disease. France, Italy, and Portugal, prominently among European governments, would have succeeded in wiping out this blot on humanity, but that almost every vessel — especially those carrying the flags of the leaders among Christian nations, American and British, where pseudo-moral citizens and subjects shudder at the mere suggestion of any regulation that shall seem to recognize the fact of prostitution, though their abstention from all regulation is the strongest recognition of the lazar-houses, which notoriously adjoin their very churches — brings new grafts of that deadly tree, which spreads its branches to take root, like the banian, wherever it can find soil. We bolt our doors upon small-pox and typhus and relapsing fever, and put miles of water between ourselves and the ships that bear them, but we allow the infected sailor and passenger to land and breathe a breath that may not only wither our own sons, but blight these pure defenseless ones, who are still nearer and dearer. How little children and delicate women are poisoned by nurses, housemaids, and cooks. How young maidens are betrayed by the kisses of lovers who would have died had they known the ruin they unconsciously wrought! How myriads of wives are made to suffer life-long agonies and go to untimely graves from the embraces of husbands, who, perhaps, before marriage had syphilis or only gonorrhœa, any physician of large sea-port practice can sadly testify! Shall nothing be done by us to check this hideous destroyer?

Finally, ships are not only carriers but generators of disease. In the history of our navy, there are many instances, where disastrous zymotic fevers have been developed on board men-of-war from the decomposition of chips planked up with scandalous criminal negligence beneath the ceiling during construction, and there left to rot with other vegetable refuse from provisions and stores, especially coal, and the putrescent microscopic organisms killed by the mixture of fresh and salt water from accidental leakage and injudicious wetting of the decks. This decomposing mass of vegetable matter, subjected to the simultaneous action of air and moisture, and high temperature, thus supplies every requisite condition for the production of malaria, and many a vessel, in consequence, carries to-day a fouler marsh in her own bottom than she can find anywhere on earth under the open heaven.

A sanitary inspection, which will make such things impossible, will not only save life but money, a double object, which should, therefore, enlist on the one hand the philanthropist, who needs no higher motive than the good of his fellow-man, and on the other, the practical economist, who coldly calculates cost and measures results in coin.

MARINE HYGIENE ON BOARD PASSENGER VESSELS.

PRACTICAL CONCLUSIONS BASED UPON THE EXPERIENCE OF OCEAN LINES IN COMMUNICATION WITH NEW YORK.

By A. N. BELL, M. D.,
of New York.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

Whoever will take the pains to become familiar with the unsanitary conditions of ocean travel for about fifty years previous to, and at about the time when the modern sanitary movement took its rise in England, will be at the first struck with the graphic descriptions of the proverbial "middle passage" — of human beings stalled, packed and shipped as merchandise. But, on further inquiry, it will be found that the prominence given to the special subjects of the "middle passage" seems to have served the purpose of detracting attention from equally abhorrent conditions in the transportation of European emigrants. Fifty years ago the common height of a ship's steerage-deck was four to five feet, and the orlop-deck, into which passengers were also stowed, was simply a "black hole" afloat. Ten deaths for every hundred passengers during the voyage of such vessels was considered healthy; and from twenty to thirty, for every hundred, not uncommon.

Taking all the data accessible, it appears that on the passage, and in the various emigrant hospitals in the United States ports, during the same year, 1847, the number of emigrants who perished from ship fever was not less than twenty thousand. The ratio of sick on board ship, per one thousand, during the while was: on board British ships, 30; American, 9.40; German, 8.60. On board vessels from Northern Europe, and particularly from Hamburg and Bremen, ship fever and want of food were almost unheard of. The Bremen authorities were the first who, about 1830, required masters of ships to furnish cooked provisions for their passengers. Previous to that time, all emigrants, and for several years subsequent, all except the Bremen emigrants, were required to provide themselves with food, and to cook it as best they could. The consequences of this negligence were that many embarked without any provisions at all, and very few with sufficient supply; many miscalculated the duration of the voyage, and fell short before its end, and had no means to buy; and for those who had food, the inadequacy of the cooking arrangements was disgraceful in the extreme. For a period of more than twenty years last preceding, and ending as recently as 1855, *there was not probably one* of all the emigrant ships from British and Irish ports

which embarked *with a sufficient quantity of proper food* and means for cooking it, for all on board.

In 1855 Congress passed an Act requiring Havre and Liverpool passen-

TABLE

Showing the Number of Passengers brought to New York by Sailing and Steam Vessels, and the comparative Births and Mortality on the Voyage for ten years—from 1864 to 1873, inclusive.

	Steamships.						Sailing Vessels.						Totals.					
Years	Number of Vessels.	Cabin Passengers.	Steerage Passengers.	Births.	Deaths.	Ratio of Deaths per 1,000.	Number of Vessels.	Cabin Passengers.	Steerage Passengers.	Births.	Deaths.	Ratio of Deaths of Steerage Passengers per 1,000.	Number of Vessels.	Cabin Passengers.	Steerage Passengers.	Births.	Deaths.	Ratio of Deaths of Steerage Passengers per 1,000.
1864	196	9,729	78,200	46	74	.80	349	773	102,070	186	750	7.34	545	10,502	180,270	232	824	4.57
1865	220	14,621	112,701	52	118	.93	302	661	83,770	186	581	6.92	522	15,282	196,471	238	699	3.55
1866	401	27,507	156,931	83	816	4.20	349	636	74,898	162	851	11.36	750	28,143	231,829	245	1,667	7.18[1]
1867	464	29,187	193,445	99	255	1.14	282	543	48,495	127	494	10.18	746	29,730	241,940	226	749	3.09
1868	451	27,937	180,449	96	200	.96	200	241	31,953	102	393	12.30	651	28,178	212,402	198	593	2.79
1869	504	29,471	229,190	110	210	.82	209	273	28,333	76	138	4.87	713	29,744	257,523	186	348	1.35
1870	484	28,262	194,088	105	155	.65	156	268	18,824	47	110	5.84	640	28,530	212,912	152	265	1.24
1871	574	31,392	213,698	80	194	.79	122	108	14,969	42	85	5.06	696	31,500	228,667	122	279	1 22
1872	626	36,716	274,889	114	197	.62	96	82	18,367	61	286	15.57	722	36,858	293,256	175	483	1.64
1873	699	37,590	257,545	123	230	.77	49	65	8,762	35	105	11.98	748	37,655	266,307	158	335	1.25
	4,619	272,472	1,891,056	1,008	2,449	Average 1.16	2,112	3,650	430,441	1,024	3,191	Average 9.14	6,733	276,122	2,321,577	1,942	6,241	Average 2.78

1 Cholera year.

ger vessels to include food and cooking in the prices of the passage, giving two tons of space to each emigrant, and providing for ventilation of the steerage. But about the time of this provision for the better construction

and management of sailing vessels, steamers began to take their place in the passenger traffic. In 1856 three per cent. only of the total number of emigrants arrived in steamers. Three years later, 1859, the average ratios were 230 by steamers to 184 by sailing vessels; 1868, 489 to 204; and in 1869, 517 to 183. The comparative mortality on board the sailing vessels and steamers speedily demonstrated a large advantage in favor of the latter. Out of 180,449 passengers in 451 voyages by steamers there were 200 deaths; while among 31,953 in 200 voyages by sailing vessels there were 393 deaths. In 1869, among 229,190 passengers in 504 voyages by steamers, 210 died; among 28,333 in 209 voyages by sailing vessels 138 died — showing a ratio of deaths five times greater in sailing vessels than in steamers.

England passed laws governing the carriage of passengers by sea, in 1852, 1855, and 1863; providing an abundance of wholesome cooked food; limiting the carriage of passengers to two decks only; requiring the sexes to be berthed separately; restricting the number of passengers to space (on the upper passenger deck, one statute adult to every fifteen clear superficial feet of deck; on lower passenger deck, one to every eighteen clear superficial feet; provided, nevertheless, that if the height between such lower passenger deck and the deck immediately above it shall be less than seven feet, or if the apertures, exclusive of side scuttles, through which light and air shall be admitted together to the lower passenger deck, shall be less in size than in the proportion of three square feet to every one hundred superficial feet of the lower passenger deck, no greater number of passengers shall be carried on such deck than in the proportion of one statute adult to every twenty-five clear superficial feet thereof); providing for qualified physicians, and numerous other wholesome restrictions, — all enforced by competent officers, rigid discipline and penalties, which have had the effect of placing the marine hygiene of passenger vessels on an equal footing with the best conditions of civic cleanliness in the most enlightened communities.

The Cunard Company's fleet consists of twenty-four ships. From New York to Liverpool, during the year 1875, the above-named ships carried 5,440 cabin passengers, and 4,314 steerage passengers. From Liverpool to New York, during the same year, 6,378 cabin passengers, and 6,972 steerage passengers. In 1876, landed at New York, 6,372 cabin passengers, and 3,425 steerage passengers. Carried from New York, 5,200 cabin passengers, 4,038 steerage passengers.

Present fleet of the Inman Steamship Company, twelve ships. Total number of passengers, cabin and steerage, carried by Inman steamers *from America*, 1866–1875, inclusive, 150,406; number of deaths, 110.

The Anchor Line: New York and Glasgow service, six steamships; New York and London service, four steamships; Mediterranean and New York service, fourteen steamships. Passengers sailed from New York, 1873–1876, inclusive, in cabin, 7,806, and in steerage, 32,684; total, 40,490. Passengers arrived in New York, by this line of steamships, during the same four years, in cabin, 7,326, and in steerage, 45,423; total, 52,749; number of deaths, 28.

IV.

TOPOGRAPHICAL AND SANITARY SURVEYS.— OTHER WORKS FOR PUBLIC HEALTH.

THE RELATIONS OF TOPOGRAPHICAL SURVEYS AND MAPS TO PUBLIC HEALTH STUDIES.

By JAMES T. GARDNER, C. E.,
Director of the State Survey of New York.

AN ADDRESS AT THE ANNUAL MEETING, BOSTON, OCTOBER 6, 1876.

Some relations of general climatic conditions to the health of man have long been recognized; but modern investigations prove that *local* causes are as active and effective in producing disease, although more subtile and secure in their operation.

The natural local conditions most seriously affecting health, are conformation of the earth's surface and its underlying structure.

Though there is ample evidence that the topography and geology of man's home are exercising a potent influence upon human health, yet the exact effects produced by various formations are little understood from lack of facts upon which to base conclusions.

In determining laws of action of the earth's surface structure upon health, two things are necessary: —

Detailed and exact records, over large geographical areas, of topography and geology with resulting natural or artificial drainage.

Public health-records of the regions.

Facts of the first group must be ascertained by careful topographical and geological surveys, and registered in maps and sectional diagrams, presenting to the eye perfect pictures of surface-formations and material structure.

These works should be followed by an equally accurate *sanitary survey*, based upon these maps to which reference shall be made at every step of such survey.

The laws of the earth's surface-influence and action upon health will then be derived from the philosophical and practical study of the facts acquired in the surveys.

I HAVE left the field duties of our State survey, among the beautiful hills in central New York, and come here to help, if I can, this Association's noble work of arousing and directing American thought in public health studies, by pointing out the importance and necessity of pursuing certain lines of investigation neglected in the past. The world's old but tireless search for the sources of health has taken a new direction. Primitive man found, as he thought, the direct origin of all ills in deities whose vascillating human passions must be propitiated by gift and sacrifice.

Then dawning science, recognizing the force of atmosphere as a bearer of heat, cold, and moisture, sought to explain the distribution of prevailing diseases by influences of climate, and the popular mind of to-day still clings to many of these doctrines, and under the stroke of pain, bows in blind submission to mysterious powers of the air. But a revolution is taking place in modern thought. The whole tendency of recent investigations proves

that *the controlling cause of our most fatal diseases is to be found in local conditions.*

Powerful as are climatic influences in modifying forms of life, science teaches that death dwells not so often in the "viewless winds," which man can neither direct nor restrain, as in the earth beneath his feet, whose form and hygienic characteristics he may mould or change.

Can any one read in the report of the Board of Health of New York that two thirds of the deaths from diphtheria in that great city were among occupants of first and second floors, and not feel that the ground about our dwellings is playing a fearful part in swelling the daily list of deaths?

Fourteen years ago Dr. Henry I. Bowditch demonstrated, before the State Medical Society, that certain conditions of the soil slew annually, in Massachusetts, a thousand of her citizens by consumption alone.

I come before you, therefore, as a student of earth's surface-structure, to call attention to the fact that *sources of many prevailing diseases are to be found in various natural conditions of earth's form and substance*, as well as in soils polluted by man. *It cannot be too clearly understood, by every intelligent householder, that the topography and geology of his immediate neighborhood are exercising a controlling influence on the condition of his family; promoting either health and happiness, or sapping the lives of those he loves.* How important, then, that all should know the earth-features favorable to human development! And yet the physician cannot, to-day, direct, with certainty, the anxious inquirer to those localities best suiting physical welfare, nor warn him of unseen dangers surrounding his residence. Laws governing this relation of earth and man are only partially known or guessed at. The time has come when they ought to be determined, and taught in every public school. Our present knowledge of the subject is too general and undemonstrable to be either convincingly taught or practically efficient. For a hundred years a connection between certain topographical features and malarial fevers has been noticed. Some marshes produce miasma, was the sum of past observations; but malaria appeared accompanying such varied topography that no law of its production was seen until latterly, when character of rock and soil is shown to be as important as conformation of surface in promoting or suppressing malarial fevers, and also rheumatism, cholera, diphtheria, pneumonia, consumption, and many other of man's worst ills. *These diseases appear to be dependent both upon circulation and excess of soil-moisture.* The connection of geological and topographical structure with health will then be evident, when it is remembered that *natural drainage results from combined action of configuration, character of soil, constitution of underlying rock, and the form of its surface.* These four elements regulate natural drainage. Each must present favorable conditions, or deadly waters will accumulate on the surface or in hidden strata. *Remember, too, that no plan for artificial drainage can be completely successful unless based on a thorough comprehension of the natural drainage system of the area under treatment.*

The region above the Palisades on the Hudson, furnishes excellent illustration of these statements. The plateau fronts the river eastward with a

bluff 300 feet high, and westward slopes gently to the Hackensack Valley; its altitude and proximity to the sea both tending to temper the summer climate. All topographical conditions of unusual health seem here present, and yet malarial diseases abound. The reason for this will probably be found in the configuration of the rock. The dense basalt underlying the thin soil of the plateau, absorbs almost no water. Its surface, originally nearly level, was worn by glacial action into low, swelling ridges and shallow rock basins, many of which having no outlet, hold stagnant water as great saucers would. The earth conceals them; but their effects are often worse than those of exposed ponds. If the rock were either fissured or porous, the height of the plateau would insure perfect under-drainage; but as it is, we have probably on the Palisades topographical conditions favoring health, while underlying structure is the governing cause of prevailing diseases.

In contrast, consider the formation of the Helderberg plateau, lying also near the Hudson River.

An escarpment 1,000 feet high bounds, on the eastern side, the table-land, composed of horizontal limestone resting on shales.

I recently examined the natural drainage system of this elevated region. From the more level parts water does not pass off by surface streams. Low undulations divide these areas into many separate basins, each draining toward its own centre, where a funnel-shaped opening in limestone receives the disappearing flow whose future course is subterranean. These basins are from a few acres to three or four hundred in extent. Where one covers about five square miles, a pond is formed at the point of central drainage, finding outlet through fissures of the limestone below. The plateau's elevation insures that these waters sink at once many hundred feet, or escape in springs along the cliffs. The Helderberg Highland presents, therefore, an admirable illustration of one of the combinations of topographical and geological structure necessary for healthfulness. But this same Helderberg limestone, under different topographical conditions, has proved one of the most powerful producers of disease.

When cholera prevailed in this country, the mortality at Sandusky was excessive, and some observers hastened to the conclusion that limestone regions were especially liable to the terrible scourge. The press gave publicity to the hypothesis; thousands of people were alarmed, and doubtless the disease was aggravated over limestone regions by excited fears. The truth, as explained by the State Geologist of New York, Professor James Hall, appears to have been this: Sandusky is, indeed, underlaid by Helderberg limestone, through whose many open fissures much foul surface-water of the city easily and certainly found its way downward; but, as the streets have an elevation of only thirty or forty feet above the lake, the drainage sank this small distance and there remained, while its poisonous gases rose continually through the same open fissures by which the water descended; proving that the very geological conditions which, in combination with other topographical features, appear most favorable to health, here spread beneath Sandusky a deadly network of open drains with no outfall. If further facts

are necessary to illustrate the powerful part that earth's structure is playing in our struggle for life, turn to those reported by Dr. Henry I. Bowditch, in his admirable paper on "Consumption in New England, or Locality one of its Chief Causes." His map of the distribution of consumption in Massachusetts shows towns where the disease is most rife, side by side with those where it is rarest. Even in one half of some towns consumption will prevail, while the other is almost free. Here, doubtless, the lungs are most affected by local causes. What, then, are these local causes? Dr. Bowditch thinks that the most powerful agent is "soil moisture," resulting from certain combinations of geological and topographical structure. The facts stated are many and significant, but perhaps none are more marked than those from the town of Greenland, N. H. This town has three distinct divisions of soil: 1st. A higher and dryer sandy plain. 2d. A medium, fertile, rather moist portion. 3d. Extensive low marshes. Seven hundred and fifteen residents are about equally divided between the three districts. During ten years three people died of consumption on the sandy plain, five in the medium, and ten in the wet region. Here, out of the same number of people, three times as many died in the lowland as on the higher ground. But in the town of Saccarappa, Me., where the hills are of a clayey loam, and the valleys gravelly, thirty-one per centum of the deaths on the hills were from consumption, and only sixteen per centum in the plain district.

One cannot read such facts, placed in their proper relation in Dr. Bowditch's paper, without being convinced that there is an intimate connection between earth's surface structure and the disease which causes from sixteen to thirty per centum of all deaths in New England. At the same time, however, the reader is forced to acknowledge that Dr. Bowditch had not at command those facts necessary to prove exactly what structural features produce consumption. Why he did not have the facts, and why no physician can now have them, will be evident from the illustrations that I have given of the probable cause of disease on the Palisades and at Sandusky. The source of the trouble in these regions is doubtless a geological feature which none but a special student of structure could discover. In this grave matter I am forced to speak of probabilities, when we ought to have the certainties of physical law; because the statements laid before you prove not only a vitally important hygienic connection between man and geological and topographical structure, but they show also how vague and uncertain our information is concerning the laws governing this relation. *These laws can never be demonstratively known until a detailed topographical and geological survey is made of some large area, and followed by a thorough sanitary survey of the same region.* I am before this Association to-day principally to impress this point, *that the geographer and physician must work together in study of the public health; and that to discover causes and determine laws they must pursue the only method known to science — first collect and classify facts, then compare them.*

The geological and topographical structure, controlling, as it does, both natural and artificial drainage, must be determined by observers trained in these special branches of science. Their labors must result in maps and

diagrams, picturing to the eye earth's surface configuration and hidden anatomy, and in records of the chemical constituents of rocks, soils, and waters. Every hill, every stream, each plain, each pond, each swamp, must appear upon the map, and all buildings, roads, and important artificial works, in their true relations to the natural features. Then let the philosophical physician place beside these structural maps and records his carefully collected statistics of diseases of this region, arranged according to geographical distribution, and the general laws governing the relation of earth's features to health will unquestionably appear. The conditions that doubtless modify and mask these laws in many localities, will also be de tected by referring to recorded observations of the sanitary surveyors in each district. Gravelly slopes might, in general, prove extremely healthful, while in special cases those residing upon them would, perhaps, be excessively liable to disease. Here the records of the sanitary surveyor would, perhaps, show cesspools, so placed that their poisonous waters would permeate the soil and pollute the wells. Without a record of the existence and position of these sinks, the law of the hygienic action of structure would appear to be reversed, when in reality the results exactly accord with the general law. The very geological and topographical conditions which normally are most healthful, easily change under human treatment into sources of sorrow and death. Careful records by sanitary observers must thus supplement the work of topographers and geologists, before the necessary data can be supplied to make an investigation, which shall render laws of healthfulness in residence sites so evident that every school-boy may know them. *From the united results of topographical, geological, and sanitary surveys of a large area, I believe it possible to deduce, with absolute certainty, the principal causes of prevailing diseases, and to point out practical remedies that will reduce the death-rate to one half its present amount,* and banish from the world an untold weight of suffering and sorrow. Can any triumph of applied science be greater than this?

The admirable report of our honored Secretary, Dr. Elisha Harris, and Mr. Fred. Law Olmstead, assisted by the geologist Professor Newberry, and by Messrs. Richardson and Trowbridge as Civil Engineers, on the causes of prevailing diseases on Staten Island, and the improvements necessary to secure healthfulness, is a model of what can be done in a private way toward solving the general problem; and it is to these and similar efforts that we owe our knowledge of the general lines upon which to pursue final investigations. But these gentlemen who have labored so devotedly to gather data, which, though defective, still indicate laws, are the ones who most clearly understand that *the great body of structural and sanitary facts necessary as a basis for the science of public health must be collected by trained corps of observers acting under State governments.* Private effort has, I believe, already demonstrated that *State topographical, geological, and sanitary surveys should be made, before the most important laws of health can be determined.* If this be so, then the American Public Health Association ought to publish the fact, and the proof of it, throughout the land.

REPORT ON THE PREPARATION OF A PLAN FOR A SANITARY SURVEY OF THE UNITED STATES.

By ELISHA HARRIS, M. D.,
Chairman of the Committee.

PRESENTED AT THE ANNUAL MEETING IN BOSTON, OCTOBER 6, 1876.

In accordance with the instructions given to this committee at the third annual meeting, the study of suitable plans and subjects of inquiry in a general survey of sanitary conditions in the United States, has been pursued, with the design to devise some method by which the preliminary steps of such a survey may be taken. The report which was submitted at the Baltimore meeting by Dr. J. S. Billings, the first chairman of the committee, was accompanied by a valuable memorandum on the study of Medical Topography, and they appear together in the second volume of transactions. The schedule of inquiries therein proposed, admits of ready use and of fairly correct returns wherever there are good sanitary authorities to offer their coöperation. The purposes of any general survey which shall promote the interests of public hygiene and extend the boundaries of sanitary knowledge, will require that the plan itself shall be based upon the chief questions and physical conditions concerning which local observers will give correct and abundant information. The sources of such information now accessible are, *First*, Educated physicians, and officers of municipal and State governments; *Second*, Civil engineers and State geologists; *Third*, The gentlemen who have been officially engaged upon the census of States and of the nation; *Fourth*, Governors and Secretaries of States, and the State archives relating to public lands, swamps, canals, and hydrographic and other topographical surveys; *Fifth*, And in many respects the most important of all sources of assistance and advice, — the Medical Bureau of the United States Army. The Marine Hospital service and the Medical Bureau of the Navy can in like manner render aid in the researches that relate to the coast and littoral regions, and the causes of insalubrity in commercial ports and along the shores of our navigable waters. To these various sources of useful contributions to the general result of the comprehensive inquiry implied in the phrase "sanitary survey," there will naturally be added the recorded observations and results of life insurance companies and the suggestions which the experience of the oldest of the companies may offer.

To coördinate all these sources of information, and render them tributary to a well compacted scheme which shall be adapted for practical uses of each of its parts, and even of incomplete results as the survey and inquiry are going forward, is the problem now before this committee, and it is pro-

posed to take conference with the expert representations of each of these sources of tributary aid. But during a period of financial embarrassment like the present, it is practicable only to *prepare* for work upon which the expenditure of time, much labor, and no small amount of money will be necessary year by year, from beginning to end, in the execution of it. The geological surveys in various States will aid, but not satisfy the requirements of a sanitary survey. More complete topographical description, and a somewhat exact hydrographical and altitude map of every district that is to be the subject of sanitary description and history in the proposed inquiry or survey will be necessary. The work of Engineer Kirkwood in the survey and mapping of the fluviatile and pond basins of Massachusetts, the contour-mapping and the sewerage and drainage charts of the city and vicinity of Providence, by Engineer J. Herbert Shedd, the maps and reports of Professor Newberry's geological survey of Ohio, and of Professor Cook's of New Jersey, and especially the plan of the topographical survey of New York State now in progress under its director, James T. Gardner, C. E., begin to give practical illustration of the topographic basis which must be provided in a real sanitary survey. And in the preparation of the outlines for the survey, this committee will regard with deep interest the progress of all accurate and skillful topographical and hydrographical surveys and mapping, because upon them rests the basis of all correct knowledge of sanitary geography and local hygienic history. The health of towns and districts, and the records of destructive diseases must be interpreted in the light of sanitary topography and the environment of human habitations.

The Signal Service Bureau will become an important tributary to the practical results of the inquiry proposed by this Association. The weather and storm charts are widely awakening the popular mind, and proving how even the winds and temperatures are obedient to the universal reign of law. Already there is general interest in the relations of climates and localities to diseases and the chances of steady health and long life; and as the science of sanitary topography and geography maps out various local conditions which are recognizable as causing or contributing to health or disease, this subject will have special significance in the minds of the people.

It will be highly desirable for this committee to be able to collate and submit some of the evidences of the local conditions and physical circumstances that are tributary in the most important manner to health or to disease, to vigor and longevity, or to sickliness and mortality. Great practical problems in social and political economy are found to require a comprehensive knowledge of the laws of healthy life. This committee cannot overlook this fact. Its preliminary schedule of inquiries recognizes it, and as the scheme is pressed forward the evidence will appear that the sanitary, social, and economical interests of a people are marvelously coördinated. Those schedules, as submitted by the former chairman, Dr. Billings, serve well their purpose of indicating the proper direction of such inquiries as admit of direct questions and answers. The mapping of sanitary geography and plan-

ning of the general *reconnaissance* preceding the development of a full series of inquiries must, if possible, be completed before the commencement of the next census enumeration in 1880. This Association may reasonably hope that the National Government as well as State authorities, will, before that time, render such direct assistance in matters of topographical and hydrographic surveys and charts, with other data, that the prosecution of the proposed great inquiry may indeed be a sanitary survey.

If it be true, as M. Bouchardet has remarked, that "misery and malaria dominate hygiene," this survey will need to be as active and efficient in arraying the facts that concern the housing and the municipal hygienic care of the people, as in also arraying the facts of sanitary topography and all the general and local causes of avoidable sickness and untimely death. Like Old England, our country has "large tracts so much healthier than the rest that they may justly be called salubrious fields." Our unhealthful districts and insalubrious cities and villages are already known to have the chief causes of their misfortunes wholly within their own bosoms, — removable at will by sanitary works. To bring forth the testimony of experience, and the decisions of science on this subject, and array the proofs which hygiene can offer in favor of definite improvements which the people and the government may undertake, will necessarily be among the first fruits of the survey. To render the salubrious districts and most favored towns still more constantly healthful, and to show how the local conditions of insalubrity in the unhealthful places can be superseded by sanitary improvements which shall elevate them to the favored condition of salubrity, is the objective point in the proposed sanitary survey.

WATER SUPPLIES FOR LARGE INSTITUTIONS AND SMALL COMMUNITIES.

By J. HERBERT SHEDD, C. E.,
Providence, R. I.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 5, 1876.

Need of good water supplies; qualities; quantities; sources.
Supply by gravitation, by pumping, by wind, by water, by steam.
Storage; purification; conveyance by pipes; fixtures.
Disposal of the defiled water.

In whatever direction our attention is turned, we find that water is an essential element of existence. Not only is this true of animal and vegetable life, but, also, in its combination with mineral matters it is essential to that condition of the surface of the earth which makes it a fit place for the habitation of man. The presence and need of water is nearly universal. It is no less a primary want of human life than air and food. The result of all past observation and experience has been to bring out more strongly the decided effects, on the health and prosperity of a community, arising from the quantity and quality of the water at its command. A subject of such vital importance as water-supply demands the most careful consideration, as its influences for good or evil are of the gravest character. The increasing causes of contamination of the ordinary sources of supply render it necessary for us to turn our attention to sources more remote from dwellings and industrial establishments than has hitherto been required.

The need of water in a community may be classed in two divisions, — public and private uses. The public uses are such as for extinguishing fires, cleaning streets and sewers, for public fountains, baths, and similar purposes. The private uses are for the household, for manufactures and other purposes affecting each consumer individually. It might be supposed that a supply for household uses could be safely left to private effort, though when used it is soiled and must be got rid of, and the manner of doing this will affect others in the community; it may be by contaminating their source of supply, or causing foul exhalations, which the air will take to their dwellings. But whatever may be thought of the need for joint action to secure common protection in this respect, the more public uses imperatively require the joint action of the whole community, and are of such magnitude as to exceed all ordinary, minor means of supply. As the demand for water is liable to occur at any time for any purpose, and is certain to occur for some purpose, in a community at all times, so the supply should be constant, certain, and easily obtained. To secure these conditions the works should be simple, permanent and in duplicate parts; furnishing water in full sup-

ply, under good pressure, at every needed point, ready to flow at any moment by operating the proper fixture. These conditions should be secured by works that will combine the least expense of construction with the smallest current expenses. For household purposes, water that is comparatively pure is required; but for washing the streets, flushing sewers, extinguishing fires, and some other public uses, this is not necessary. Under rare circumstances it might be desirable to supply water for these different uses by separate systems, but as a rule only one kind of water can be supplied to a community, on a large scale, and that must be sufficiently good for drinking.

Quality. — Drinking water should be transparent, colorless, and well aërated. It must be without taste, free from animal organic matter of any kinds, without smell, and deposit no sediment on standing. It should be cool and have no particles suspended in it. The total dissolved constituents must be within certain amounts. Efforts have been made to define these amounts for each principal kind of impurity, and they were summed up by Dr. Parkes, with some limitation, as laid down after much discussion by various sanitary congresses; but there is such a diversity of opinions among eminent men in regard to the quantity of such matter that may be safely allowed in drinking-water, that a statement of his figures would seem to be of little value, especially as methods of analysis have recently been much changed so as to separate matters that he classed together. He gave, for instance, the limit of "organic matter" as 1.5 grains per gallon, while it is now known that the character of the organic matter is of much more consequence than the mere quantity. There is great difficulty, in considering potable waters which contain organic matter, in distinguishing between such combinations as are innocent and such as are noxious. The opinions of scientific men of the highest reputation are divided upon this question, as might be expected from the subtle character of the elements which enter into its determination, which do not admit of the satisfactory kind of treatment usually expected from the modern advanced state of physical science.

In his testimony before a "Royal Commission on Water Supply," Dr. Parkes gave his more mature, but less definite, conclusions on this subject, from which I quote as follows: "In my minute of the evidence that I proposed to give, I attempted merely to form a sort of standard which might be understood by the public as to what waters were best. It seems desirable to give the public some sort of idea what waters may be used or what may not be. There are difficulties in forming a standard which may not be objected to by scientific men on account of the difficulty of making the evidence very precise upon such a point as this, and therefore such an enumeration of waters as I proposed must be received merely as an attempt, without pretending to anything like scientific accuracy; but I think that the following standard of water will convey the most important points connected with the supply of drinking water. I would propose to form a class of 'wholesome waters' under which two sub-classes of waters may be included: first, the purest and most wholesome water, which is free from suspended matters, and contains very little dissolved organic matters, say under one grain per gallon, and that probably vegetable, and of dissolved mineral

matters under seven grains per gallon. That will include all the waters supplied from the primitive rocks, and from some of the sands which contain under that quantity of mineral matter, and is probably the purest water on the whole which can be obtained in that way. Rain water after filtration might come under the same standard.

"Then the second sub-class in the first order would be what I would call pure and wholesome water, to which no objection can be taken, I believe, in a sanitary point of view, but which is not so pure as the former. This water is also free from suspended matters, having dissolved organic matter under two grains per gallon, the greater part of that being vegetable. Of dissolved mineral matters it would contain under twelve grains per gallon, consisting principally of carbonate of lime, and alkaline carbonates, and chlorides. That second sub-class would include the best chalk-waters, which are often very free indeed from organic matter.

"Then the second grand class I would make, I would propose to call 'usable waters;' waters which cannot, perhaps, be very much objected to, not so good as the former class, but yet which in many cases might be used, and which would not produce, perhaps, any bad effects. Those are all waters with no suspended matters, or suspended matters easily separated by the coarse filtration usually resorted to by the water companies. The organic matter would be chiefly vegetable, but it should not exceed three grains per gallon, owing to the diseases which would probably arise if it exceeded that quantity, and if the organic matter is apparently of animal origin, it ought not to exceed two grains per gallon. Then it should contain mineral salts not exceeding twenty to thirty grains per gallon, and consisting of a class of salts which do no injury to the system, such as alkaline carbonates, alkaline chlorides, chloride of sodium, and chloride of potassium, in less quantity, and possibly a little carbonate of lime also. I would exclude sewage throughout.

"The third class would be what I would call 'suspicious water,' which would be any water with much matter suspended, which would be separated readily by coarse filtration. Such a water as that would in all probability contain either fine particles of mineral matters, which are hurtful, such as clay, or possibly it might contain suspended organic matters very finely divided, and not very readily separable by filtration. It might contain dissolved organic matters, vegetable and animal, amounting to about three or four grains per gallon, and mineral matters of large amount, such as alkaline and chlorides, carbonates, and carbonate of lime in large amount, that is to say, perhaps over nine or ten grains per gallon, or sulphate of lime or magnesia, and chloride of calcium or magnesium in certain quantities: all those I should consider make a water suspicious; or, if it contains any indication of nitrites, nitrates, ammonia, etc., showing that organic matters had passed into the water and had there been oxidized, any indications of that kind I should consider would bring the class under the head of 'suspicious' water.

"Then the fourth class would be 'impure water,' which would include any turbid and bad smelling water, with suspended matters not easily sepa-

rated by coarse filtration ; also, dissolved organic matters above four grains per gallon, especially if of animal origin, large quantities of mineral substances, especially of sulphate of lime and sulphate and chloride of calcium and magnesium, which all give permanent hardness to the water, or large indications of nitrites, nitrates, fatty acids, ammonia, etc., all of which indicate the passage of organic matters — animal in all probability — into the water.

"To sum up, I would propose, as a popular division, these classes : —

"(1.) Pure and wholesome waters.

"(2.) Usable waters.

"(3.) Suspicious waters.

"(4.) Impure waters.

"The definition of each would be as above stated."

If a water contains much chlorine or much common salt, it is suspicious. Chlorides in water may come from an infiltration from the sea or from strata containing a quantity of common salt, but the usual source, in waters that would be under consideration for a water-supply, is pollution by sewage. The average amount of chlorine in the sewage of water-closeted towns is one hundred parts in a million. Pure natural waters contain about ten parts in a million ; and if more than this amount is found in a water proposed for domestic use, an examination into its source should be made to determine whether that is objectionable.

Nitrates and nitrites are commonly considered to indicate "previous sewage contamination," as in most cases they come from the oxidation of organic matter. But they are found to some extent in all waters, and their mere presence is not enough to cause a water to be rejected. Their source and amount must be determined. Where the amount is found to be from two to four parts in a million, in water supplied for domestic use, it is not supposed to be sufficient to cause injury to health. It might be, however, that in such water particles of sewage, containing germs of disease, had escaped transformation, in which case they would be dangerous, and in this form they are believed to be as yet beyond the reach of the chemist or microscopist. Salts of ammonia strongly indicate sewage contamination. In exceedingly small quantities they may be contained in all natural waters, but if the amount rises above one tenth of one part in a million it is suspicious. Two methods have been practiced for representing organic matters in analysis. In one they have been given as organic carbon and organic nitrogen. In the other, known as "Wanklyn's method," the nitrogen contained in the organic matter is converted into ammonia, and is estimated as ammonia under the title of "albuminoid ammonia." If this matter rises above one tenth part in a million, by weight, the water is bad. Water is supplied to some communities, however, which has three or four times this amount of albuminoid ammonia ; and in one case of a public supply it has sometimes risen to ten times this amount, or to one part in a million. This water is very bad, and when drank by those unaccustomed to its use is likely to produce diarrhœa or other diseases. The danger from organic matter in drinking water arises from its being in a state of putrefactive

change, and that it may, and often does, when derived from excremental matter, contain the poison of specific diseases, which may be distributed in the drinking-water and cause an outbreak of cholera, typhoid fever, etc.

All water percolating through or flowing on the surface of the earth, owing to its solvent power, takes up more or less mineral matter. Except in those cases where the excess of such matters gives the title of "mineral waters," the essential ingredient is almost always carbonate of lime with a few other salts in subordinate amount. Water charged with salts of lime has the property of destroying soap to a certain extent, by the combination of the lime with the alkali. Such water is known as a "hard water." A certain quantity of soap is expended in neutralizing the lime before the soap will dissolve freely, and make a lather. The loss is ten grains of soap to one grain of lime. One grain of lime in an imperial gallon of water is called one degree of hardness. Perfectly pure water would absorb only about two grains of carbonate of lime per gallon; but carbonic acid gas, which is found to some extent in all natural waters, gives a greatly increased capacity to take up this salt. Other salts than carbonate of lime, in a limited degree, cause hardness in water. The hardness that depends upon the presence of carbonic acid gas is called "temporary hardness," and that which remains after this is expelled, by boiling or otherwise, is called "permanent hardness." The temporary hardness is often more than two thirds the "total hardness." The amount of permanent hardness is a very important matter, as it cannot be removed on a large scale, and it indicates the presence of salts which are injurious. A water having a high degree of permanent hardness is almost always a bad water for drinking as well as for culinary and manufacturing purposes.

For drinking purposes the presence of carbonic acid gas and a considerable degree of temporary hardness is generally considered to make a water palatable, and is believed by many to be harmless, though there is some evidence to the contrary. Habit has much to do with this matter, and a change either from hard to soft water, or soft to hard, is likely to be prejudicial. In some diseases hard water has, undoubtedly, a bad effect; and, in general, it may be said that soft water is the safest. Water that has more than six degrees of hardness is called hard. Whatever may be thought of the merit of hard water for drinking purposes, there is no question but that soft water is better and more economical for other household and manufacturing purposes. This is specially true in comparison with a water that has large permanent hardness. For making tea or coffee, or cooking vegetables and meats, when it is desired to extract their juices, there is great advantage in soft water. For all purposes requiring the use of soap the economy of soft water is very great. It was estimated that the supply of a river water to the city of Providence, in the place of the well water which had been used, would cause an annual saving of $42,000 to the citizens in the item of soap alone. Writers upon this subject say the saving of wear and tear of clothes in washing is fully equal to the saving of soap. Since the introduction of water to the city, one large taker, who keeps a restaurant, says he has found the saving on his bills for soap is fully equal to his annual water-rate. Or-

dinary well water has often a hardness of fifteen degrees, while many river waters have less than one degree. The loss of soap before any of it becomes available for cleansing would be about two pounds in a hundred gallons of the hard water above that required in the soft water. Mr. Bateman estimates the saving of soap in Glasgow after the introduction of soft water at about $75,000 per annum.

The saving by using soft water for general manufacturing purposes is very great, as is the economy of coal for steaming purposes. The corrosive action of soft water upon lead and iron is usually greater than that of hard water.

Quantity. — The quantity of water required by a community depends very much upon the habits of its people. If the use of water-closets and private baths is general, the demand for water will be greater than it would otherwise be. A large amount of water is needed, also, to supply hand hose, particularly in dry weather, where its use is allowed for watering grounds and streets. For purely domestic purposes, including water-closets and an ordinary use of baths, a daily supply of ten or twelve gallons for each person is sufficient, making a fair allowance for waste. In model lodging-houses, where water is not stinted and every appliance is used, a supply of seven gallons per day for each person has been found sufficient; and within my observation this has sufficed for a private family having modern conveniences in the house, with water carried to the various rooms, and used freely, but with a consciousness that all that was drawn from the pipes must be supplied by hand-pumping. Mr. Muir, engineer to the New River Company, in his testimony before the Royal Commission on Water Supply, said: "I have made experiments upon a pretty extensive scale, for the purpose of ascertaining what would be a fair amount for various purposes in London. In houses of an average class, where means were taken to prevent waste, but where there was no stint (where there was a full allowance of water), the consumption has not exceeded seven gallons per head per day. In houses of larger class the consumption is somewhat greater, and in small houses somewhat less. But I have been in the habit of allowing ten gallons per head per day as ample for ordinary domestic purposes."

But while this quantity furnishes a good supply where the pipes and fixtures are in good condition, and water is not allowed to run to waste, it falls far short of the amount that is usually distributed by public water-works. In this country the waste of water, where it is supplied without effort on the part of the taker, is generally very great, often amounting to two or three times the quantity fairly used. The delivery of water in Boston is about eighty gallons per day for each consumer. In Providence it is upwards of 45 gallons, and in New York about 100 gallons per consumer, and in Washington it is about 134 gallons for each inhabitant. In Providence an unusually large proportion of the water supplied is used for manufacturing purposes, — this being estimated at forty-four per cent. of the total quantity delivered. The estimated proportion supplied to dwellings, including the use of hand-hose, is thirty-two per cent., the remainder — or twenty-four per cent. — being supplied for miscellaneous purposes, including all leakage. These proportions are so changed by the difference in the occupations of

the inhabitants, that I estimate the amount required by New York to be for manufacturing purposes, 33.2 per cent.; for dwellings, 38 per cent.; and for other purposes, 28.8.

On account of the very general use of meters in Providence, the waste is much less than is usual, and the amount required for each purpose may be more closely estimated. It is there shown by experience that on a large scale, where forty-eight thousand people are using the water with full knowledge that the supply is practically inexhaustible, a supply of fifteen gallons daily per person is sufficient for all uses about dwellings and grounds. This undoubtedly includes much waste that might, without inconvenience to takers, be prevented; and for small communities willing to use ordinary care, the domestic supply may be fully provided by an allowance of ten or twelve gallons daily for each person. For steaming purposes a gallon of water for each pound of coal burned is a fair supply. Other uses should be estimated according to the peculiarities of each case. For waste no estimate can be made. It may, from carelessness or negligence, reach very large amounts. A single faucet in my house, if left open all the time, will discharge, by measurement, more than twenty-two thousand gallons of water per day.

Source. — Having considered the quality and quantity of water necessary to be provided, and bearing in mind the great influence of the quality upon the health and prosperity of the people, it becomes a matter of the utmost importance to select the best available source of supply. The rain-fall is the original source of all natural water supply, or, at least, that is the point in the circle of its course from vapor through rain-fall and its collection into the sea, whence it is again vaporized to appear in the clouds, at which it may be viewed as a whole most simply and comprehensively, as at the initial point or source. Condensing in the clouds, the water alights upon the ground, in inhabited countries, with considerable regularity and evenness. It is commonly supposed that rain water is purer than any that can elsewhere be found; but while there is ground for this belief in localities where the atmosphere is very pure, it is not true of localities near towns, or where, from any cause, the air is contaminated. Rain water has the advantage of being very soft, and it is well aërated, and in districts where other available water is hard, rain water is very valuable for some purposes. But it washes the lower atmosphere of its impurities, and in some cases becomes very foul. Dr. Corfield says: "Rain half a mile from the extreme southwest of Manchester, although the wind was blowing from the west, tasted flat, insipid, oily, and nauseous, deposited organic matters, and even organized bodies in considerable quantities, and left a clear water above, containing more than two grains of organic matter in the gallon."

Dr. Angus Smith, who examined this water, makes the following remarks: "It becomes clear from the experiments that rain water in town districts, even a few miles distant from a town, is not a pure water for drinking; and that if it could be got direct from the clouds in large quantities, we must still resort to collecting it on the ground in order to get it pure. The impurities of rain are completely removed by filtration through the soil; when

that is done, there is no more nauseous taste of oil or of soot, and it becomes perfectly transparent." He is therefore of opinion that rain collected directly from the air cannot, at any rate near to towns, afford a proper water supply.

Where it is considered necessary to collect and use the rain water, it should be filtered as soon as practicable after it falls. This may be conveniently done by constructing a circular brick well or cistern in the ground, with the lower portion tight, but having a wall of one thickness of brick at the upper portion, laid with cement mortar joints, around which, at a distance to leave a suitable annular space, a water-tight wall should be built, making a space to receive the rain-fall. From this space the water can percolate through the bricks, which should not be too hard burned, and fall into the lower interior receptacle. In this way good, soft water, suitable for domestic uses, may be obtained, except where great impurities are collected by the rain. In order to preserve the purity of rain water its exposure to light and heat should be prevented, which can be most conveniently done in such an underground cistern as has been described. It should be well ventilated, and great care should be taken to prevent communication of air between the water conductors, leading to or from the cistern, and any of the household drains. The size of the cistern should be sufficient to hold a supply for at least one hundred days of drought. A gathering area of two hundred square feet for each person would give a supply of about fourteen gallons per day, if the entire rain-fall of an average year were collected, and a supply of about eight and a half gallons in years of least rain-fall. This refers to an average yearly rain-fall of forty to forty-two inches.

An important source for a limited water supply, which has not heretofore been much used, is the flow that may be collected from the under-drainage of suitable land. This source is, of course, not available in villages or towns where the ground is valuable for building purposes. But a large proportion of our hill-sides that are under cultivation or pasturage would be much improved by tile drainage, and such lands usually yield a good and reasonably regular supply of water which can be conveniently collected for use. It is not uncommon for the location of a drainage area of this kind to be such as to furnish water under a sufficient head to flow into the highest portions of buildings in which it is required. If the land is highly cultivated the water may be injured for drinking purposes, but ordinary cultivation does not permanently injure water which, after leaving the surface, passes through several feet of earth. Water from ground composed entirely of peat or other vegetable earth would be unfit for domestic use. There is a very great variation in the amounts of water collectible by under-drainage, owing chiefly to the character of the earth and the disposition of the strata. As an average, about one sixth of the rain-fall may be expected to flow from the drains. At this rate it would require about 1,500 square feet of drainage area to yield ten gallons of water per day in the year of least rain-fall. It is not uncommon for land drains to flow continuously through the year, but in many situations a storage for times of drought must be provided. The rain water which percolates through earth, which is in its natural state,

to the general water-table beneath the surface, is filtered of most of its animal and vegetable impurity, and in case the filtering material contains little soluble mineral matter, the water becomes pure and palatable. In this state it often issues from the ground at low points, in the form of healthful springs. But in the neighborhood of habitations, soiled and impure water filtering through the earth leaves a large part of its filth in the ground, which after a time becomes so filled with foul matter as to cease its action as a filter. In such case the rain water passing through this earth becomes filthy and unfit for any use, except, perhaps, as a manure. Wells sunk through the earth into the water-table at even long distances from such a source of contamination are liable to be injuriously affected. Water drawn from the well is replaced by other water flowing in from all sides, and the flow of the underground drainage is thus naturally drawn towards the well. I have known the lowering of water at one point to draw water from a distance of several hundred feet. Foul and blackened earth has often been traced directly from the cesspool to the well, and also from the cesspool to the cold air passage of the house furnace. Dr. Corfield says, "The well waters of London mostly contain more chlorine than sewage; they are, in fact, a concentrated form of sewage which has gone through certain alterations;" and again he says, in regard to the salts of ammonia, "Sewage contains about sixty parts in a million. Well water often contains large quantities, forty parts, for instance." The well waters of towns are often dangerous, and in very many cases only persons in good health, who gradually become accustomed to their impurities, can use them with safety. That the pollution of the well waters of populous places is very general and constantly increasing, is well known. Analyses of the waters of about fifty wells, in eleven different towns, show an average impurity of 46.82 grains per U. S. gallon; while twenty-five samples of water supplied by public works to twenty-one towns have an average impurity of 5.89 grains. In Providence, the waters of twenty-four wells had an average impurity of 39.65 grains per U. S. gallon, of which 10.59 grains were organic and volatile. In Lowell, fifteen wells had an average of 39.33 grains, of which 7.23 grains were organic and volatile. Of the latter, several wells contained very good water. But there is danger in using the water of any well near which refuse from dwellings is deposited. Although the soil has great power in oxidizing the most objectionable matters before they enter the wells, it is certain that this power cannot be retained for any great length of time, as the sources of contamination increase.

Very deep wells that are protected from shallow drainage are usually free from much organic matter, although they are likely to contain large amounts of mineral matter. Shallow wells ordinarily catch only the adjacent percolating water, and, therefore, cannot be depended upon to give a large supply. Deep wells, sunk into permeable and water-bearing strata, derive their supplies from more extensive sources, and the amount is mainly limited by the friction of the water in passing through the interstices of the earth.

The quantity of water to be expected from a well cannot be estimated, in any case, except by the aid of information obtained by experiment. The

theory of the probable supply is called the cone theory, in reference to the form of the drainage area contributing to the supply of a well; that being represented by an inverted cone, the apex of which is at the bottom of the well. But as perfectly uniform strata, of very great extent, is rarely met with in nature, it is impossible to lay down any definite rules for determining the probable yield of water.

The water that can be obtained from springs has the advantage of an even temperature, which, except in surface springs, is about fifty degrees of Fahrenheit, in our latitude, in summer and winter. It is well aërated, clean, bright, and agreeable to the taste, having considerable carbonic acid in solution. It varies very much in quality according to the place from which it is taken or the strata through which it percolates. As a rule, if freed from surface contamination, the quicker a spring is affected by the rain-fall the purer it will be, because it has less time to gather mineral matters in solution. The water of surface springs is often contaminated by impurities from the surface which may not be entirely removed by filtration. Dr. Frankland has recently recorded a remarkable case of the passage of the poison of typhoid fever through a mile of porous earth, under a mountain, in Switzerland, to appear in a spring on the other side, where it spread the fever throughout a community using the water. All spring water contains more or less mineral matter which it has dissolved on its passage through the earth. This may render the water hard, and therefore less fit for domestic use than a softer water which it may be true economy to obtain, even at greater first cost. The purest spring water comes from the older rocks, which yield in many cases pure water without a large amount of salts in solution. In clay countries, the waters often contain considerable sulphate of lime, in which case they are permanently hard and unwholesome.

River water is often purer than spring water; but, on the other hand, it often occurs under favorable circumstances, that spring water furnishes the most desirable source of supply available for domestic purposes, and sometimes a sufficient supply of such water may be obtained for a large population. The volume of water and the constancy of a spring depend upon the extent and character of the strata combined with the rain-fall. Springs issuing from permeable strata are ordinarily variable, unless the volume is great and the supply distant. In the case of a "fault" where an impervious mass intervenes when an extensive permeable stratum overlies an impermeable, the volume of water yielded is often very great and the supply permanent. Springs in primary strata are usually permanent as well as those in limestone countries.

A "drainage area" is a more visible source of supply, and one that is capable of more accurate estimate than that of springs. The yield from such a source depends upon the rain-fall, the configuration of the district, the character of the earth, and the state of its cultivation. In estimating the quantity likely to be furnished, it is well to consider not only the apparent area, but the geological area, as it often happens that a supply may be increased by springs fed from sources beyond the apparent area, when the dip of the strata is in the direction of the drainage area; while, on the

other hand, the supply may be diminished by the passage of water through an absorbent strata dipping in a contrary direction. The proportion of the rain-fall that can be collected varies materially with the physical character of the district. It has been found to vary, within the United States, from fifteen to ninety per cent. of the rain-fall. Perhaps a fair average of the amount collectible is about half the rain-fall ; but we can only rely with safety, for important uses, upon the supply that can be obtained in the dryest year, or, if the storage capacity is very great, upon the supply in the three dryest years. From twelve to fifteen inches in depth can ordinarily be saved in this part of the country. In reference to the quality of the water, the most important thing to guard against is surface contamination.

The most universal and reliable source of water supply, on a large scale, is from rivers, in which term it is intended to include ponds and lakes, which are ordinarily but enlargements of brooks or rivers. The observations in regard to the supply of drainage areas will apply to rivers as well, but it is not generally so important to make detailed examinations of the water-shed unless it is proposed to take nearly the whole flow of the stream. River waters often have a slight tinge, particularly in autumn, which is an objection to the eye ; but in most cases about here this is probably quite harmless, as it arises from the same property that gives color to tea, which is not known to be injurious. Sand filtration removes it entirely. Attention has recently been conspicuously called to the contamination of river waters, and not too much can be said or done to secure their freedom from impurity ; but as a matter of fact rivers furnish the best sources of supply, on the whole, and efforts should rather be made to keep them pure than to discourage their use.

THE SANITARY APPOINTMENTS AND OUTFITTING OF DWELLING-HOUSES, REGARDED AS ESSENTIAL AND OBLIGATORY.

By EZRA M. HUNT, M. D.,

Secretary of State Board of Health of New Jersey.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 4, 1876.

Domestic water-supply, and its management to prevent household evils.
Best provisions for dust and sweepings.
Disposal of domestic garbage and ashes.
The drainage of defiled fluids from the cleansing of clothing and utensils.
Disposal of excremental matters.
Practical plans for these indispensable sanitary provisions; outline of a new method; legislation to define and make them obligatory.

At the first meeting of the Public Health Association it was my privilege to urge the need of such Sanitary Organization as would reach to the household life of all our people. The condition of each dwelling and its locality being a primal consideration at the second meeting, we gave attention to Building-ground in its relations to health. At our last meeting we treated of the building itself, its Materials and mode of Construction, in their relations to health. We now in a brief paper desire to close the series, by some remarks on Inside Appliances, Methods, and Connections requisite for sanitary household administration.

The subjects of Heating and Ventilation were dwelt upon while considering the arrangement of windows, sky-lights, sun-exposure, etc., and have been more fully examined in some articles in the "N. Y. Medical Record" (Nos. 272–276), in a review of the Johns Hopkins Hospital plans. This will leave for us as our present subjects water-supply, gas fixtures, and all Constructive Arrangements and Connections needed for the sanitary handling and disposal of excrement, and the various offal incident to housekeeping.

Water-Supply. — The evils of imperfect or laborious water-supply are so obviously such as beget and perpetuate uncleanliness, that, from this outlook alone, we would need to insist that all households be abundantly supplied with water for all cleansing purposes. When in addition we recognize that water has to do with most of the methods for the removal of refuse, and so is both a cleanser and a common carrier, the need of easy accessibility is still more urgent.

As this water is relied upon also for potable use, the pipes conveying it into the house, and the mode of egress and reception therefrom, must be such as in nowise to jeopardize its purity. The pipes must, therefore, be so impervious as not to admit of the absorption into the water of foul gases from any vicinage through which they pass. They must not deposit any injurious metallic or other substance, and the faucets also must be of such

material as not at all to change the character of the flowing stream. To this end, it has, we think, been shown that tin or glass-lined house-pipes are in general to be preferred to lead or iron. It is not always to be determined in each case whether the water is being contaminated by lead and iron. When used in the house the pipes are often too thin, or by the necessity of stiff joints more apt to have leakage or erosion at points out of sight. It may be here said in general of all conduction pipes either carrying material into or out of houses, that it is desirable as far as possible to have them accessible, not only for ease of repair, but that the need therefor may be more readily declared.

When pipes lead from a well, as this in relation to the house-pipe is only its reservoir, the only additional precaution is that it should not be allowed to touch at its lowest point the bottom of the well, and so bring sand or settled organic matter through the pipes. If the water-supply is by a house-cistern, as is now the preference of individuals in some cities where the aqueduct water is suspected, the material and cleanliness of the roof leaders and cistern demand notice. The overflow pipe must not be connected with the house soil-pipes, and the distribution must be through tubes such as those already noticed.

But the great caution needed as to water-supply is as to its administration and disposal. Water has such a transparent and reputable character that the sanitarian sometimes gives to it a too hasty approval. It may readily become the bland menstruum for manifold contaminations. Stagnant water, moisture where it should not be, or demands for excessive indoor evaporation, beget some of the most unfavorable circumstances for salubrity. How quickly pure water may change into foulness is often shown by exposing water to sunshine, or keeping it in any place stagnant for a short time. When water is daily fouled the danger is all the more imminent. Such liquid will do but little toward cleansing itself. It is not as quickly aërated as befouled air. Especially is this true when it is in house-pipes, or when spilled about or allowed to soak into porous material about sinks or waste closets. It breeds the very spores which are related to disease. When water is added to filth, decaying organic particles, the mixture is prepared for fermentation and for noccuous productivity. There will be germination as surely as when the seed sprouts by the aid of moisture. "Of Ferments," says Simon, "moisture is the normal medium." There is probably no more prevalent cause of disease than dampness under such circumstances. Water abundant in a house and not properly disposed of, or too lavishly fouled, is not pellucid with innocence. In many of our Hospitals, even the habit of wet-cleansing of floors, walls, etc., is becoming more restricted. Every housewife knows that the under sink-closet, if at all saturated with water, is one of the most difficult places to keep in good condition. The indoor atmosphere and underground evils arising from lavish water-supply must not be overlooked. The last report of the New York Commissioners of Public Works states a daily water-supply of ninety-five gallons for each citizen, which, in proportion, is nearly twice that of a Londoner. Even the private house supply is probably an average of forty gallons per person (see "Weekly

Post," September 13, 1876). It is not surprising that the question, both from scientific and clinical observation, has of late pressed itself upon us whether consumption and other lung affections, rheumatism, diphtheria, and the zymotic (fermentive) diseases in general, do not owe their incubation and propagation more to superabundant moisture than to superabundant filth. If filth is only "dirt out of place," is not disease-water and dirt together out of place, and so the cryptogamous result of their union amid household life. Every water-pipe, every sink, every wash-tub, every bath-tub, every wash-bowl, every faucet is in its degree an introducer of moisture, and house dampness and soil dampness are promoted by all undue use.

Let it be an axiom that no more water should be introduced into a house than is needed for potable, culinary, and cleansing purposes, and when used for purposes of cleansing or otherwise care should be taken to insure subsequent removal both by proper drying and conveyance process.

Gas Supply. — The next article most frequently introduced into houses is gas, through pipes running in almost every section of the buildings. This, if escaping, always contaminates pure air and unfits it for healthy purposes. Besides, it not infrequently contains impurities which, if allowed to escape from imperfect pipes or fixtures, add to its noccuousness. The odor which is almost always apparent in excavating for the pipes shows how frequently the soil is impregnated. The gas is in the pipes under pressure, and so seeks points for escapement. Often the pipes are themselves too pervious, and there is still more need to insure the perfection of gas connections and jets and burners through houses. Even where no distinct odor is perceptible, there may be light escapement. When burning and turned on with full jet, not only is an unnecessary amount of carbonic oxide produced, but there is addition to the air of other gases. In examining the air of various public buildings, says Prof. Endemann,[1] "the combustion of illuminating gas as an air deteriorator proves to be of immense importance."

The next question which arises is as to the disposal to be made of the residuum, offal, or excrements incident to household administration. These may be spoken of under five heads: —

I. The dust gatherings arising from house upholstery, clothing, dry lodgments from the air, and from the persons of the occupants.

II. The refuse from fires.

III. The coarse offal from culinary processes.

IV. The fouled water resulting from baths, from the cleansing of clothing, and from utensils and household apparatus.

V. The special division of animal excrement.

Of these, the first represents no unimportant organic matter, but it is in a condition least liable to do injury if disposed of by dry handling. If not, this varied mingling of particles from contaminated air and dust and from the insensible excretions of the body, causes that accumulation which gives the peculiar smell to impregnated clothing and uncleanly persons in untidy households, and which, by the practiced nostril, is easily singled out from the recognized stenches of out-of-door life.

[1] *N. Y. Health Report*, 1872, p. 305.

For this dry debris there is no disposal so satisfactory as the fire. It is easily conveyed in a lidded dust-pan, and when properly added to the glowing coal of the kitchen or furnace is at once deprived of any possibility for mischief. Since the perfection of the reverberatory furnace in connection with the plan of cremation, it certainly becomes a question whether this kind of disposal may not be applied economically and effectually to great masses of lifeless matter. We are not sure but that when urn burial shall have resumed its place amid mediæval relics, there will remain to us valuable suggestions in this other line. Be this as it may, we are sure that greater importance should be attached to the daily disposal of all sweepings and dry filth by means of ignition. They have in them so much of material which heat and moisture are capable of stirring into Pandoral productivity that they should never find place for accumulation, but be disposed of in this easy and harmless way.

II. The refuse from fires seems in itself so pure of any factors for disease that it would scarce seem worthy of note except that by filthy additions and by absorption of moisture it sometimes becomes a nuisance, and collaterally, and perhaps somewhat directly, a source of unhealthfulness. In our American cities, if this mass could be freshly handled and the good coal sifted, both it and the siftings would be available and go far toward defraying the expense of removal and separation. We have only to say that the prompt removal of all fire refuse should be provided for by municipal regulation, and will hereafter indicate the most feasible method, unless the present barrel and ash cart method is satisfactory.

III. The coarse refuse arising from culinary processes, such as the unedible parts of all vegetables and fruits, the scraps and cleansings of animal food and fish, and shreds and parts connected therewith, marks another separate kind of offal incident to household administration. First of all it is desirable for future handling that all such material be separated into the solid and liquid portions. The carriage and disposal of all such solid matter is greatly embarrassed by any liquid additions thereto. It is entirely feasible, for instance, that the pealings of food which is cleansed in water be poured in a sieve sink or colander, so that all liquid may drain off. The offal which is thus left is always valuable as a food for animals, and will pay at least for its own transportation. It should be kept in a metal receptacle, provided with proper cover, and should be changed in summer each day, and at other times twice per week, for a cleansed one prepared for exchange. This, in all cities, in a way hereafter to be indicated, should be under municipal jurisdiction. It is because such material is mingled with too much liquid or retained too long or added to ash heaps or other refuse, that it becomes intolerable. The only embarrassing animal or excremental matter which may naturally be found in this garbage is that derived from the cleansing of fish or the drawing of poultry. It is happily becoming more and more common for these to be thus far cleansed before delivery, and general law might easily require this, and hold dealers responsible for cleanliness in methods of disposition.

Under the easiest and most feasible household and civic administration

there is no possible reason why the culinary refuse should become a nidus for health-depressants, or its removal be complicated either on the score of foulness or expense.

IV. We next pass to the notice of the fouled water resulting from ablution, and from the cleansing of clothing, floors, culinary matters and utensils, and household apparatus generally. The sanitary significance of these mingled waters is benign or malignant, just according to the time and modes of handling. If removed within the lapse of a few hours, through sewers which are capable of being reached and cleansed, the disposal of this liquid, which forms the main bulk of all sewage, is not complicated. Were this the only sewage, the vexed problem of sewage disposal, yet unsolved, would be greatly simplified. It is this which forms the over fifty gallons per day for each person which pours its flood of waters through hidden channels with foul banks, and which, with all known excrement and other refuse added thereto, becomes a fearful mixture, capable of converting pure waters into the river Styx. If kept free from excremental pollutions and those of fouling factories and abattoirs, and if such establishments are located out of cities, or compelled to disinfect their fouled fluids, or deliver them to proper water-courses in separate conduits, beneficent results to household health would accrue. Even with this separation, the house pipes should be very smooth on the inside, with few joints, not running together unnecessarily, of small calibre, and cleansed at least each week by pouring through them a solution of caustic potash, followed by a stream of hot water.

The only seeming necessary contamination is that arising from the soiled linen of children under two years of age, or in a limited number of cases of sickness. By usual habit this wash is kept distinct from that of the general laundry, and is easily transferred to the urinal (as hereafter indicated) or disinfected before being thrown with any other cleansing wash. With such precautions the resultant sewage would not need a River's Pollution Commission to sit *sine die.*

Yet even for this it is to be noticed that we insist upon delivery into an accessible sewer, the plan therefor being more fully stated in our last section. Even from this fluid, contamination would result to the sewer itself, if not accessible, which might find its way through house pipes into the dwelling. Through months and years of use, particles of clothing material, various organic matters purposely transferred from solids to liquids, and decomposed soaps returning to their acids and greases, will cling to sewers, will penetrate through pores called impervious, and prove a located and permanent defilement. We have had the opportunity to watch a tight tile drain, of five-inch calibre, situated under the most favorable circumstances. Nothing but bath and kitchen and laundry water ever found entrance thereto, — this, through a strainer or colander, with an outside ventilator and strainer also. The drain itself was flushed with pure water from the roof of a large building, at every rain-fall, and the slope toward a flowing brook was amply sufficient. Yet after four years the drain was over half full of adhering substance and required raising. The material depos-

ited was of a greasy nature and of a nauseous, mawkish smell. It was found, on examination, to be composed of shreds of woolen, of decomposed greases, fatty acids and salts, with slight admixture of sand. It is evident that the usual soaps used in all washings became separated into the foul greases and chemicals from which they have been made, and the hydrocarbon oils are returned to their former condition of rancidity. They abound in material for fermentation and putrefaction. The waste from bread, vegetables, meat, and from all household cleansings, as well as all organic material, is ready to be zymotized by such association, while the sticky tenacity of the rubber-like product inclines it to tarry all along the sewer. This may be fully and harmlessly delivered through *accessible* sewers, and passed, while fresh, into running streams, without danger to health, but it is not the flow to which all sorts of excrement and garbage can be added with impunity. All householders should be cautioned against the addition thereto of any dissolved excrement; and when such discharge is detected issuing from the pipe, entering the tunnel sewer, it must at once be held as a case of trespass. The house-pipe with its strainer needs but a single trap, as by the method hereinafter proposed, the sewer would cease to be the abode of contaminated air. It is quite feasible, if needed, in the case of the pipe carrying the most fouled sewage, to have it run at some point across the kitchen chimney, inside, and there have an opening and bell expansion in the pipe within reach, and governed by a faucet easily turned. This would generally be left open, so as to give free access to air and an upward draught. These house pipes would easily be kept cleansed by the potash and water, as already suggested, or by swabbing in case of straight pipes, or by having, when desired, a screw at the lower end, so that the pipe could be closed for two or three hours and a disinfecting fluid be thus held therein for a time. By means of jointed rods with a compressible swab at the end, house pipes admit of explorative cleansing. "A certain amount of slime inevitably collects upon the insides of house drains themselves, which, by its decomposition, evolves gases requiring metal joints to hold them," but on the plan suggested this would be mostly prevented and the deposit easily removed. *Never shall we succeed, however, in keeping the system of sewage compatible with health until we make the main sewers capable of patrol and thus secure their cleanliness and make the house pipes thus more accessible also.*

V. We pass now to the special division of animal excrements. These have ever been the most intractable of all household accumulations. There are those who are so appalled at the evils resulting from any indoor accommodations of this order, that they insist upon the back-yard closet alone, but even its contents are difficult of disposal. Whether we will or no, modern civic civilization evidently inclines to some form of indoor provision for these calls of nature. If we could deal with this excremental matter in its simple form as voided, the problem would be greatly simplified. For consider that the average defecation at the extreme calculation for each inmate is only two and a quarter pounds per week, or for a family of eight persons, eighteen pounds per week. As to the urine so much is evaporated or passed separately, as by the use of a urinal, to admit of separation. The

fæcal excretion, kept in a place which has free access to the outside air, and free from all moisture save the urine voided with it, "usually decomposes slowly and in hot weather often dries on the surface and subsequently changes but little for some time" (p. 337).[1] It has even been found practicable to a great degree, by means of the privy arrangement, to separate even this part of the urine so that the fæces are left dryer. Urine itself, also, when kept apart and exposed to air, retains its natural acidity for several days. When, however, added to the fæces, says Parkes, it seems "to aid the decomposition of the solid matter, or this may be, perhaps, from the effect of the fluid, *as pure water seems to act almost as rapidly as urine in this respect*" (p. 337).[1]

It would scarcely occur to a man in any natural method of disposing of an evacuation to pour upon it a gallon of water and make of it a stirabout and then set it afloat, unless it could thus be conveyed at once beyond the reach of odor or inhabitant. But when it comes to pass that neighbors by hundreds are crowded right and left upon him and all are doing the same thing, the idea is too original for thought. No such problem as this simplifies by aggregation of material. Not only do masses of filth add proportionate masses of danger, but the increase of risk is more than geometrical. Such substance has been diluted by great outpourings of clean water and then floated into great canals of soiled water of a less grade of pollution and this floated on through sewers flushed by rain-fall and reservoir, and this passed into rivers and the rivers into bays, and yet municipalities by scores and tens of scores groan with the greatness of the burden. It is the mingling of many polluted waters and the final adding thereto of the most disastrous element of fermentation and putrefaction. Simon speaks of it, as that which "of filth is the filthiest." The sewer itself becomes filthier still. The present house discharge makes the average modern sewer the paragon of nastiness, and the problem of abatement as herculean as the cleansing of the Augean stables. Without patrol its slimed inside frames iniquity against health by a law. The witches of Macbeth are needed "to charm the firm and good" into satisfied approval of such household connection and disgorgement. The method of preparation is wellnigh theirs: —

> "Round about the cauldron go;
> In the poison'd entrails throw." . . . .
> "Fillet of a fenny snake,
> In the cauldron boil and bake;
> Eye of newt and toe of frog,
> Wool of bat and tongue of dog,
> Adder's fork and blind-worm's sting,
> Lizard's leg and owlet's wing,
> For a charm of powerful trouble,
> Like a hell-broth boil and bubble." . . . .
> "Finger of birth-strangled babe
> Ditch-deliver'd by a drab,
> Make the gruel thick and slab:" . . . .
> "Double, double, toil and trouble;
> Fire burn and cauldron bubble."

Because pure water properly applied is a cleanser, or because sewer water

[1] Parkes's *Practical Hygiene* (Am. ed.), and *Seventh Report Mass. State Board of Health.*

is soiled water already, it is not a mere incidental addition to pour into this stream, through connected privy-pipes, another stream of intenser pollution. In our recent studies of the potent causes of disease, *excremental* infection takes a foremost place. It is to this that typhoid or enteric fever is often shown to owe its incubation and virulence. Cholera nestles very closely in the same vicinage.[1] Indeed Simon puts it still stronger than this, and claims that "by some aptitude which other nuisances of organic decomposition, though perhaps equally offensive, have not seemed equally or nearly equally to possess. . . . . it extends by extremely strong analogy to every disease, nominally common or specific, in which the human intestinal canal is the seat of 'infected changes.'" This is *not said of common but of excremental sewage.* In view of facts authenticated and accumulated within the last ten years as to the effects of fermenting excrement and of excremental sewage, we are forced to face the primary question, whether the house disposal is not radically wrong. Are we not, by a promiscuous mixture and by aggregation where there should be segregation, creating nuisances and then vexing our brains and our mechanism in seeking deliverance from the evils we have instituted? Are we not by our inaccessible sewer mains for such filth, making of every inch of their inside surface, dwelling-places of fermentative and putrefactive changes from which pure air itself seems to draw back in despair?

Our plan would be first of all to have the sewer not an inaccessible pipe, but of calibre sufficient to admit local patrol and cleansing. We would make it the underground passage into which all the soiled water of households (excepting excremental), should find its way by straight pipes. This at once would simplify all questions of cleansing and enable it to be kept pure and ventilated. From this street sewer we would have a recess passing to and under the sidewalk or to the area or space beneath the front door entrance of each house. We would adopt the Rochdale or bucket system for the removal of all solid excrement and have the liquid excretion pass from each house through a urinal by a separate pipe, either emptying into the common sewer or into a vat fitted for its reception, as experience and chemical examination might indicate. This recess would be accessible from the main sewer so that the fæcal bucket and *other pails of house refuse* could be received by persons in it, and placed on a tramway and conveyed to the point for removal. At the same time new cleansed vessels would be left in the place of those removed. The householder would hold the only key, and therefore the only access to this sewer recess would be from the area or house side, while if need be a similar door under charge of the sewer police might close the recess from the general sewer. Thus the whole process of deposit and transfer of all house refuse of whatever kind placed each in its own vessel, could be conducted without exposure and with a promptness and a system which would rid us of all the manifold evils of admixture and street carriage. A bell connection also could be established so that any failure to have buckets in their place would be instantly notified to the occupant. A system of this kind secures separation from the house, admits of perfect ventilation, protects from soil saturation and infection as no system of promiscuous, inaccessible sewerage can, and

[1] See *Simon on Filth Diseases*, pp. 25 and 29.

makes the method of transfer from house to sewer recess and delivery through the patrol sewer convenient. In fact the only basis on which the mixture of excremental sewage with the common sewage could be at all vindicated, ought to have as a prerequisite a sewer main capable of police patrol and cleansing. But even with this we believe health welfare indicates a separation of fæcal or other matters, and their disposal by systems of sewer carriage. Every possibility which belongs to an underground railroad system is applicable here, while such a sewer arrangement is far more feasible. If one city would thus construct a model street, we could easily test its value. An easy mode of delivery would at once be established, cleanly and out of sight. We believe by the separation of excreta, of solid or swill refuse, and of fire-refuse, each would be of value sufficient to defray the expense of transfer, or so near to it that all lack would be abundantly made up in the "expectation of life" which would accrue to each household. The main sewer would thus be kept free of odor, and, by its ventilation, keep pure the recesses. Simon says "that any sewer which stinks at its open gratings is *pro tanto* giving evidence of unsuccess" (op. cit., 38). Such an arrangement, too, by the facilities it would afford of reaching water and gas pipes would diminish expense as to these. We think it is becoming more and more certain that our crowded cities owe much of their ill health to infected soil and air infected by sewers. The experiments of Pettenkoffer show how few sewers are impervious. The experience of plumbers with whom we have talked shows us how defects occur in the thinness and joining of pipes, and from the made soils, or from rats, so that they are not responsible for the breaks, under the present system, so difficult of discovery. All this could be obviated and a system of testing and cleansing that part of the house pipe beneath the ground be instituted, if only each end was thus left accessible. The solid privy contents by this method would be conveyed regularly to the sewer recess and exchanged for a clean pail and be kept beyond the power of evil, as also swill slops and ash refuse, if so arranged.

We are told that in Providence, Rhode Island, where they have tried the pneumatic system, they have, because of the great expense, resorted to the tub system, and succeeded well with it. If only the handling of the tubs can be done out of sight by an organized patrol force, all other objections are capable of being thoroughly overcome by house organization. We recently heard a physician of China urge that one reason why epidemics were less severe in their cities is that they dealt with animal excrement in such way as not to pollute the ground. The whole embarrassment comes from composite and complicated admixture, and from undue increase of quantity. The remedy is in keeping each part distinct, in handling it without exposure, and in passing the more innocent bulk of sewage water directly into rivers, or upon sand-beds or arable land.

So long as we have the present house and street method of sewage, we shall have a foul problem, and grow sick in its solution. We may call it conservancy, water-carriage, and other unique names; but so long as the excrement of the populace is made into a great gruel, and floated hither and thither through our towns, so long shall we have wash-pots like Moab, and our places of ease will be as full of evil as was that of Eglon, its king.

No one can read the record of the Rivers' Pollution Commission, or the testimony even of those who incline to a water system, without seeing many embarrassments. These are greatly multiplied in our country, where there is little call for diluted fertilizers, where labor is higher, where the rain-fall is greater, and where the amount of water used, and the consequent bulk of sewage, is greatly increased.

Even where, because of existing sewers, it is impossible at present to substitute a patrol-sewer, we would all the more favor the tub system. It could be so arranged that these could be exchanged through gratings similar to those now admitting coal or wood, and thus avoid the necessity of back entrance, or open-day conveyance. These pails need not be large or cumbersome, and could thus easily be accessible from convenient underground vaults, with man-hole gratings near the curb of the sidewalk. It would be easy to manage the exchange of these covered pails, and replace them by clean ones, and avoid day work, and the need of entrance through houses or yards.

It would make the present paper too lengthy to express the well-weighed details of such a plan, and show both its practicability and economy. We are only sure that the arrangement of all house appointments for the riddance of all house refuse must undergo new investigation from the standpoint of separation and individual disposal rather than that of promiscuous and aggregated admixture in sewers not admitting of proper cleansing, ventilation, and patrol.

The radical method of preventing the great sewer nuisance is not to perpetrate it. If a row of houses in a street were fouled as a street sewer is fouled, and then attempted to be cleansed by letting loose hose pipes through one end and pouring the waste water out from the other, that would be flushing, but it would not bring a clean thing out of an unclean. But go in with water, and broom, and scrub-brush, and air and cleansers, and foulness could be made to cease. So only can a sewer main be cleaned. So also it can be made the passage-way for the delivery and removal of separated refuse of various kinds. We insist on the first, and suggest the second.

With water and light supply regulated somewhat as we have proposed, and a plan of removal adopted such as is herein indicated, we have the main appliances, methods, and connections requisite for sanitary household administration. With right ground, rightly arranged structure, and right methods of delivery for necessities and riddance for débris, the head of the family has the conditions for the successful management of the hygiene of his household, and may hope to have issue from its doors men, women, and children, with bodies and health fitted for the noble work of life, and all made better citizens because free from the depressions and morbidities which life amid unfavorable surroundings is too sure to originate and confirm. The well-appointed residence is like the heart to the body — central, powerful, vital to all that makes the man and the citizen.

Keep that heart with all diligence, for out of it are the issues of life.

THE SANITARY CONDITION OF COUNTRY HOUSES AND GROUNDS.

By Col. GEORGE E. WARING, Jr.,
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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 6, 1876.

The sanitary defects of the average country house are due to ignorance. Had the architect who built it been stimulated to learn what is required for a perfectly healthful condition, he would, of course, have been in every case vigilant to secure it. Did the physician know — except in a vague and theoretical sort of way — that is, did he fully realize the degree to which he should be vigilant to prevent diseases due to removable causes, connected with the construction and arrangement of the dwelling, he would insist upon a reform. If the householder himself knew the extent to which his own efficiency and the health and lives of his family depend on an observance of the less obvious sanitary requirements, he would demand that both architect and physician should inform themselves as to the needs of his house, and should secure the fulfilling of those needs. By far the greatest number of country houses are farm-houses, laborers' dwellings, etc., and these are not less subject to sanitary criticism than are those of the better class, though their defects are mainly of a different character. Unhappily, so far as the occupants of these farm-houses and cottages are concerned, there is little hope that much improvement will soon be undertaken, or, indeed, that anything we may say here will be heeded. Until we can convince the *country physician* that his most important obligation to the community lies in a supervision of the conditions under which it lives, it is hardly worth while to waste breath upon the average members of that community. We may accumulate evidence as to the fatal effect of prevalent carelessness and filthiness in the cellar, and in the soil about the house; and for every instance that we bring forward of a death from typhoid fever, traceable to the use of poisoned well-water, the farmer will produce a hundred cases of persons who have used water from wells standing in barnyards or close to privy vaults or cesspools without suffering. The action of poisoned water is less direct than that of a well-aimed rifle; and its effect, where there is any effect, is slower and less obviously connected with the cause than in a case of poisoning by arsenic. We can hardly hope, in the beginning, to convince the average countryman of his error, and induce him to spend money, and to put himself to considerable personal inconvenience to reform a state of affairs which has existed all his lifetime, and which he believes to have answered well with him and with his fathers. To his mind, typhoid fever, diphtheria, and the whole list of zymotic diseases, are

afflictions sent by an inscrutable Providence for some hidden purpose of discipline, and he believes it his duty to bear meekly, if sorrowfully, the chastening to which he is subjected. He is still very far from accepting the idea that the discipline may have for its purpose his regeneration in the matter of hygiene. *We* know very well that in its unvarying operation the sanitary law (which is not entirely inscrutable) strikes both the just and the unjust, and that its effects are disciplinary or not, according as we meet its requirements with intelligent obedience or bow blindly and ignorantly before it. Typhoid fever does not come to us as a punishment for Sabbath breaking nor for profane swearing, but as a punishment for the one sin which brings us within reach of its scourge. — the sin of unwholesome living. Then, too, sinners though we are in this regard, it touches us so slightly — only here and there a case — that we are led, not precisely to risk chances which we appreciate, but to remain placidly unconscious that the law is in operation about our own houses, awaiting only the due assembling of the conditions which bring its action to bear upon our own persons.

It is obvious that our efforts to secure an improvement in the construction and care of country houses must be first addressed to the more intelligent classes with the hope that their example will influence the poorer and less informed. Let us consider, therefore, by way of illustration, the case of an elaborate country seat, built with a determination to secure every luxury and every comfort, every convenience and every safeguard that the most skillfully applied modern art can compass, — a house to which that compound adjective, so dear to the American heart, may be applied in every department from garret to cellar, — a house where everything is "first-class."

If we consider the old mansions of our grandfathers, or go back still farther to the seats of the nobility of past centuries in England, and compare our modern houses with these, we shall realize what enormous strides have been taken in the improvement of many elements of our building. Among other things, the modern mind has at last fully accepted the fact that a wet cellar is dangerous, and is to be, in all cases, and under all circumstances, avoided or abandoned. By hook or by crook, we manage to get a drain away from the lowest point of every cellar dug in soil that retains water after heavy rains. We understand very well — in the cases of the better houses perfectly well — the importance of dry walls, at least of dry interior walls. We have learned how to warm our houses more uniformly, and we realize in far greater degree than our fathers did the importance of abundant sunlight. But here, I fear, so far as health is concerned, the sanitary improvement of our building ceases, and, as we pursue our investigations, we come to a point where it seriously retrogrades.

Half a century ago, in houses of the better sort, the most active prejudice existed against the use of any form of indoor privy conveniences, and in spite of often dangerous exposure to the weather, and of the universal stifling foulness of the out-house, no one thought, except in case of serious illness, of permitting defecation within doors. Partial invalids and delicate persons must, perforce, subject themselves to an injurious exposure. The objections to their old system were extremely grave, not only on the

score of comfort, but greatly, also, on the score of health. The introduction of the water-closet marked a real advance in our apparent civilization, and the general system of an interior water-supply and drainage, with the agreeable accessories of fixed wash-bowls, baths, laundry trays, and butler's sinks, — of what the house agents call "all the modern conveniences," — have made life easier and more luxurious. In certain ways, too, they have added important sanitary benefits.

But in freeing ourselves from the prejudices of our fathers, and in gaining these marked benefits, we have exposed ourselves to dangers which are all the more grave because of their hidden and almost universally unsuspected character. It is by no means necessary that the introduction of modern plumbing appliances into a house should be anything but advantageous; but, unfortunately, so little is popularly known of the sanitary requirements which should govern the work, and the influence of defective works upon the health of the household is of such a hidden character, that in securing comfort and convenience, we have, in almost every instance, introduced a real element of danger.

It is a matter of small consequence to the average householder, who cares nothing for the general sanitary bearings of the question, whether typhoid fever is propagated by germs, or by some agent as yet unknown. He does care very much, or at least he would care very much if he thought anything about it, that the condition of his house shall be in every respect such as to insure, beyond question, the perfect safety of his family. He does not, it is true, realize the fact which we fully appreciate, that his costly and finely finished water-works threaten the safety of his family. He has trusted to his skillful architect to make sure that he is guarded against unhealthful influences from this source, as effectively as he is guarded against exposure to the weather. He has had personally no time to devote to the work, but he feels that he has given it into hands fully competent to direct it, and he takes no further thought or trouble about it.

Unfortunately, so far as the question of health is concerned, he has as a rule trusted to an artist rather than to a sanitarian; for the average architect, however competent to plan the general arrangement of the house, and to make it — without and within — beautiful, attractive, comfortable, and convenient, is, like the average owner, too often either ignorant of, or indifferent to, the requirements of the sanitary law, as recently developed. The owner takes possession of his new house, and subjects his family to unseen and unsuspected influences which are quite likely, sooner or later, to manifest themselves in one form or other of ill health. He then calls to his assistance a physician, who, if we take an average representative of the profession, has sat at the feet of an old Gamaliel, and has applied himself far more to the art of healing than to the art of prevention. In the slight ailment, or in the grave sickness with which he has to deal, he is skillful, useful, and efficient; but surely physicians themselves will confess that, as a class, they too seldom seek for the cause of ill health in conditions which are so universal among their patients, and which obtain to such a degree in their own homes, that they are apt to be overlooked. The doctor nat-

urally refers the illness to some unusual condition, or to some unusual exposure. Indeed, it is hard to realize that conditions under which the human machine so generally works perfectly and easily, may, under certain circumstances, become the very conditions for its derangement. If we can get doctors and builders to *realize* the absolutely vital importance of securing pure and healthful homes for their patients and for their clients, we shall have done *our* best work. Mr. Brown, Mr. Jones, and Mr. Robinson, practical men, engrossed in the management of their affairs, and with a long cherished antipathy to theory and innovation, will pay very little attention to what we may say in this Hall, or to anything we may write, but they *will* listen to the advice of their physicians, and in building they will follow the least sanitary suggestion of their architects. Constant dropping will wear away even the stone of their indifference, and we shall, in time, secure a reformation of the community. Our earliest effect, however, is surely to be produced by our influence over their professional advisers, who will, I trust, not misapprehend the spirit in which we venture to tell them of this vital and too little heeded element of their arts.

Let us come now to the specification of our charge against the modern country house. It stands, we will suppose, upon nearly level land of a somewhat impervious character, but ample provision has been made for the drainage of its cellar. Not far away from it are a cistern and a well, each of which is in communication with the force-pump in the kitchen. This is provided with a twin-cock, by which water may be drawn from one or from the other at pleasure. Under the roof is a large tank holding more than a day's supply, and this, filled by the force-pump, furnishes all of the water needed at every point. Near the middle of the house, one above the other, on the different floors, are placed the bath-rooms, with water-closets and stationary basins, in the middle of the house, to be safer from frost. The attempted ventilation of these rooms is often only by a window into a closed well, or through a small register in the wall, opening into a small rough flue in the chimney, throttled from bottom to top with projecting bricks and lumps of mortar. The real ventilation is through the open doorway into the interior passages of the house. In each bedroom, or in a closet attached to each bedroom, there is a stationary wash-basin with hot and cold water. Under the staircase in the main hall, and often with no ventilation at all, are the conveniences of the master of the house himself. The butler's pantry has a sink, connected with the main outlet drain by a generous pipe. The kitchen sink has the same connection, and so have the laundry trays, which, together with the servants' closet, are often near the level of the cellar bottom, near the zero point of the drainage system. The house has been built by contract, and a plumber, whose specification has related chiefly to the weight of pipe that he shall use and to the character of finish of the basins and bowls, and their faucets and plugs, has been left to the exercise of his own discretion as to the arrangement of all the hidden parts of the work. His job is satisfactory if the tubs and trays and sinks and basins have the proper neat look, and if an abundance of water is everywhere supplied, and everywhere flows readily away. For

an outlet, he has been provided with two cesspools. The first, tightly cemented, has a trapped overflow; the second, receiving the overflow of the first, is built with uncemented walls, with a view to the percolation of its contents into the soil. For a time everything works smoothly and well. The clean, new outlet pipes perform their office satisfactorily, and the clean soil about the leaching cesspool does its purifying work completely. The house is acceptable in every way, and its happy owner congratulates himself that he has secured all that modern art and knowledge can give him.

Let us examine this house, after it has been a few years in occupation, with a view to studying its actual sanitary condition. We will disregard, as foreign to our immediate subject, the flood of injurious carbonic oxide which its registers pour into its interior, and the sad lack of ventilation which the substitution of the furnace for the open fire has inflicted. We will say nothing of the pressure of soil water against the absorbent cellar wall, nor of the damp emanations from the undrained heavy ground around the house. Let us confine ourselves only and strictly to the questions of water-supply and drainage. The well, although perhaps not very near the leaching cesspool and the now foul soil surrounding it, may get its water through some stratum of gravel which carries the ooze of this cesspool, or it may penetrate a permeable stratum or a seam in the underlying rock, which brings it into communication with other cesspools or privy vaults far or near. These impurities are not, perhaps, enough to produce an obvious effect, while the water in the well is high and holds back the water in the soil, as the land water in the beach holds back the salt tide. But when the supply fails in time of drought, then the demand on the well is replaced by a flowing in from the foul earth, and the impurities are concentrated to a dangerous degree. Or, perhaps, the dejections of a patient ill with typhoid or diarrhœa enter the stream oozing from the cesspool to the well. In either case disease follows.

The tight cesspool, into which the drainage of the house discharges, is, of course, hermetically sealed, that there may be no possibility of its emanations tainting the air. It is connected with the outlet of the soil pipe by the best vitrified pipe carefully laid. This pipe, for part of its course, runs through soil that had been excavated and refilled at the time of building, — through soil, that is, which is sure to settle as time goes on, bringing the weight of the whole mass above the pipes to move them enough to open their joints so as to allow more or less of their contents to soak away into the ground. Sooner or later this leakage penetrates the foundation wall and taints the air of the cellar.

A strong, well-constructed, four-inch iron soil pipe descends from the trap of the highest water-closet, usually in a straight line, through the main floor of the house, by the timbers of which it is supported, making it quite likely that a deflection of these timbers of even a quarter of an inch, will tear it loose from its attachment with the closet and leave a little crevice for the escape of its gases. The importance of ventilating the soil pipe having been recognized, a one and one half inch lead pipe, leading from its highest point, has been carried out through the roof, closed over at the top to pre-

vent the admission of obstructions, and perforated with a dozen little holes to give egress to the pent-up gases. This is not *ventilation*, it is only *venting*, only the relieving of pressure, — an important office, but by no means a sufficient one. The closets on every floor are of that ghastly, foul sort which hold in a lower unventilated chamber nearly all that is admitted to them save the water alone, until the solid matters, by decomposition, are enabled to follow the stream, which was insufficient to flush them away *as* solids. The traps of the lower closets, too little air being supplied through the small venting holes above the roof, are often emptied by siphon action, when a strong flow is rushing through the pipe from the emptying of a bath on a floor above. To economize the work, traps under the wash-basins are frequently omitted, an introduction of the waste-pipe into the trap of the water-closet being deemed sufficient, even where the communication is by means of a long and nearly horizontal waste pipe.

In time, the foul contents of the cesspool, and the foul sliming of the soil pipe, having been, for months or years, producing acrid gases, the leaden traps under the closets and horizontal leaden connection pipes have gradually become more or less honey-combed, and, here and there, openings have appeared. These, being in the upper sides of the pipes, where the usual plumber's inspection for leakage does not detect them, they remain quite unsuspected, and they go on year after year pouring out into the house their poisonous exhalations. The influence of even very small openings of this sort is far greater than would at first be supposed. I was recently told of a household in New York, which had for years been a reliable source of income to its attending physician. After his death a younger doctor, an enthusiastic sanitarian, who succeeded him, soon became convinced that the illness which had so long prevailed was due to emanations from the drainage pipes of the house. Plumbers were employed to make a thorough inspection, and they reported everything in perfect order. The cases of disease kept coming, and an inspector from the Board of Health examined the house, finding no defect. The character of the recurring ailments indicated so clearly a foul-drainage cause, and no other, that the physician finally applied himself to a minute inspection of every part of the work.

On the waste-pipe under a wash-basin, in a room communicating with the nursery, he detected a very slight oozing of moisture, so slight that he did not feel sure that it existed until he found that it moistened tissue paper laid over the spot. The most rigid scrutiny developed no other leak. This pipe was taken out and a new one substituted, and, although he or his predecessor had been called to attend some member of this family almost weekly for a dozen years before, he was not called again for eighteen months, and then only because of the stock. If anything is certainly known with reference to the house-drainage question, it is that in an unventilated system of pipes, the foul matters which they contain enter into a putrefactive decomposition, which produces poisonous, or at least injurious, gases; and if anything is clear to the common comprehension, it should be that pipes of a corrosible material like lead, made by human hands and subject to the defects of all human work, containing, day and night, gases of this character, are danger-

ous inmates of any inhabited house. Not only do these gases find their escape through defective joints, through the perforations of old pipes which they themselves have destroyed, and through traps whose sealing water has been sucked out by a flood rushing past them in the soil-pipe, — but they have, as has been clearly shown by the experiments of Dr. Fergus, of Glasgow, the power of passing almost unretarded and quite unchanged, through this very water seal upon which we have so long depended with confidence.

Given the cesspool and the soil-pipe, charged with injurious air, it is simply impossible that, under our ordinary methods of arrangement, this air can be prevented from mingling with that of our imperfectly ventilated sleeping-rooms and living-rooms. Every safeguard that modern experience has suggested should be applied from the beginning to the end of the system to make sure that, whatever may be the character of the aëriform contents of the pipe, they shall be strictly barred from escape into the house, and that every means shall be adopted to cause their discharge into the free air above it.

Not only this, but means should be taken to prevent the *formation* of these gases, and thus to gain the double security of their non-existence in their worst form, and of the impossibility of their entering our houses in their modified form.

Poisonous sewer gas is usually a product of the obstructed decomposition of organic matter in the absence of light, and of a sufficient supply of oxygen. In its most dangerous form it is believed to have but little odor. If the decomposition takes place with exposure to a sufficient supply of common air to furnish the oxygen needed for a more complete decomposition, not only are the gases produced — although often more offensive in their odor — less dangerous to health, but the more thorough decomposition is believed to be accompanied by a destruction of the germs of disease. These gases have in a much less degree, if they have it at all, the power of decomposing lead pipes. In other words, this worst enemy of those who live in modern houses may be entirely or quite disarmed by the simple means of supplying common air to all parts of the drainage system.

The effect of this ventilation should be made to extend, so far as possible, throughout the branches of the system, and with a view to this the water traps — which, although they are not the most effective appliances in the world, are still sufficiently useful to be retained — should be placed as near as possible to the waste outlet which they are to protect. Where the outlet of a wash-basin, for example, is untrapped until the water seal of a distant closet is reached, it becomes in time smeared for its whole length with the accumulated soap and filth of repeated ablutions ; and these, although not what we recognize as fæcal matters, are still organic matter of similar chemical character, and they produce in their decomposition, although in much less quantity, the same sort of gases. Let every trap, then, be as near as possible to the beginning of each waste-pipe, and let the main soil-pipe be entirely untrapped, so that, as far as may be, every outlet drain in the house shall be in free communication with a thoroughly ventilated main channel. This secured, we may rest content in the belief that so far as lies in our

power, we have prevented the formation, anywhere within our drainage system, of gaseous emanations which can be injurious to health.

The next step is to make sure that while we have disarmed our concealed but ever present enemy, we bar every avenue to his nearer approach. He may perhaps no longer be dangerous, but we can never be quite sure of him, and he would at any rate be an offensive and disagreeable visitor. As a first step, in the place of strapping our soil-pipe to the beams of the cellar ceiling, let us set a stout post, bearing upon a firm foundation, directly under its bend, and so prevent the possibility of its settling a single hair's breadth. In this way we may keep a well made joint with the water-closet trap perfectly tight. As a next step we must either abandon all of our plumbing appliances, save only the necessary water-closets, and return to the old basin and pitcher, and the sponge bath, or we must provide for the *absolute shutting off* of every overflow and waste pipe which is now separated from the drainage system only by an ordinary water trap. The water seal is a trap in more senses than one. Dr. Fergus found all gases with which he experimented to pass freely through its sealing, — ammonia passing through and reacting upon litmus paper in fifteen minutes. In cases where the trap is not frequently used, the evaporation of the sealing water leaves it open for the passage of air from the drain directly into the room. All of these defects are constantly present even in the case of water pipes which are not subjected to pressure from the confining of their gases ; wherever there is such pressure, the evil is of course greatly aggravated.

The unquestioned advantages of a free supply of pure water in wash-bowls and bath-tubs on every floor of the house can be safely secured only by some system which shall overcome their great defect, — which far outweighs all their advantages, — the defect of affording a possible inlet for sewer gas into the interior of the house. As at present constructed, it is safe to say that there is not a butler's sink nor a bath-tub nor a wash bowl in use which is not to a greater or less degree subject to this criticism. The only safety is to be sought in supplying a self-closing stop-cock to every waste-pipe or overflow-pipe, so arranged that it can be kept open only while it is actually held open by the hand. Any device for fastening it open during the convenience of the user would result in its being neglected and left open when it should be closed. To those who have given no thought to this branch of the subject, it may seem a super-refinement of criticism to make this sweeping objection to an appliance of modern life, which is in such general use in town and country ; but I believe it to be susceptible of proof that of all the causes of the various zymotic diseases which occur in our otherwise well-appointed houses, by far the greater number have received their filth-born impulse from poisonous gases escaping through the overflow and waste pipes of wash-bowls, bath-tubs, and sinks.

With a means for drawing water on each floor, and with a water-closet through which to dispose of slops, the labor of attending our old friends, the bowl and pitcher, is not serious ; and such an arrangement offers absolute security against a defect which has thus far not been remedied. The kitchen sink makes no slight demand upon our consideration. Its outlet

offers a passage, not, it is true, to fæcal matter, but to every sort of organic substance from which fæcal matter is made, and which may supply on its decomposition precisely the gases which are generated in the soil-pipe. It does not carry the germs of disease, — assuming that these are germs, — but its scraps of food, etc., are, on the other hand, mixed with congealed grease, which covers them to a certain degree against the access of oxygen, and tends to make their decomposition especially foul. Add to this the serious objection, that the congealing of the grease has a tendency to obstruct the waste-pipe, and lead to leakage and subterranean overflows of a serious character. The methods for overcoming these difficulties are well known, and may be easily applied. The leading safeguard in the whole matter, here as elsewhere, is to be sought in the free ventilation of the waste-pipe at a point as near as possible to its source, and in the introduction of an efficient water-seal and grease-trap.

We come now to the method of finally disposing of the liquid waste of the house. Any one who has had much experience in the examination of house plumbing and draining must have come to the conclusion that those cases are really few in which even the defective methods adopted have been executed in anything but a defective way. The sanitary formula of Hippocrates, "Pure air, pure water, and a pure soil," is violated hardly less often by the earthenware drain without the house than by the waste-pipes within it. A vitrified earthenware drain laid on a firm foundation, and well closed at its joints with good cement, is as perfect an apparatus for conveying foul liquids as we can well conceive of; but far too often the cementing is much less than perfect, and, in almost a majority of cases, the pipe at some point rests upon new filling, which, by a settlement of a single half inch, is quite sure to open a crevice at the joint through which the trickling filth escaping from the house may find its outlet. Wherever it is necessary to pass through anything but the original, unbroken, and solid earth, the excavation should be carried down to the original undug bottom, and filled to the grade of the drain with well compacted concrete. We must either do this, or else substitute a stout iron pipe wherever new filling has to be crossed, however firmly this may have been rammed.

Having a pecuniary interest in the success of the flush-tank invented by Mr. Rogers Field, one of the leading sanitary engineers of England, I have some delicacy about its advocacy here; but, perhaps, the fact that I have taken such interest in its introduction is the best evidence of my faith in its value. This tank is simply an apparatus for accumulating the trickling flow of liquid waste to the amount of from twenty-five to thirty gallons and then discharging it rapidly by a siphon, which is brought into action automatically. The accumulation then escapes in a rapid and cleansing stream, sweeping everything before it through the outlet drain. During the accumulation, the grease is congealed and separated. The flush-tank should be so arranged as to receive the kitchen waste and whatever other liquid it may be convenient to deliver to it, but not the wash from water-closets. This should enter the drain farther down its course where any deposit it may leave will be swept forward by the action of the stream from the flush-tank.

The disposal of liquid waste is one of the most serious elements of our subject. In the town, where we have a public sewer which may be depended upon for removing whatever we deliver to it, however defective this may be in the eyes of the public sanitarian, the problem is completely solved so far as the householder is concerned. He may easily make such a disconnection of the channel which brings his soil-pipe into communication with the public drain as to insure himself against danger from this source of poisoned air. But in the case of a country house, where the amount of liquid is large, and where there is serious danger that we may contaminate the source of our drinking water, or render the air about us impure, too much attention cannot be paid to the securing of a perfect method.

So far as I know, there are but two permissible devices in use. One of these, and it is the most objectionable, is an absolutely tight cesspool, well ventilated and accessible for inspection and cleaning, but from which not one drop of liquid can filter away into the soil, — care being taken to empty it in such a way as to produce the least possible offense. The other is the system recommended by Mr. Moule, the inventor of the earth-closet, for the disposal of the liquid through permeable drains lying within reach of the roots of plants, and in the well aërated surface soil, whereby our foul offscourings may be largely consumed and purified by vegetation, and be destroyed by effective oxidation. This system has long been used in a small way in many places in England, always with perfect success; and it has, during the past six years, served its purpose most effectively at my own house in Newport, where every gallon of waste water has, I feel confident, been purified and consumed by the soil underlying less than one thousand square feet of lawn. Indeed, so well am I assured of the efficiency of this system of subsoil irrigation, that I am now applying it for the disposal of the entire sewage of the village of Lenox, where a flush-tank having a capacity of five hundred cubic feet will periodically deliver its contents through about ten thousand feet of two-inch tile lying twelve inches below the surface, and having an uncemented joint at every foot of its length.

Time does not permit me to consider, as I should be glad to do, the broad and important question of the removal, by under-draining, of the soil water from retentive lands forming the lawns and gardens of country houses. Concerning another branch of our subject I would suggest that the day has passed when it is necessary to say a word before such an association as this on the subject of that crowning abomination, the old-fashioned vaulted privy. We still accept it as an evil which has too much headway for us to stop it at once; but those of us who have not been misled into believing that the "odorless excavating apparatus" has made its continuance permissible, do not need to be reminded again of its entirely uncivilized character and of the unhealthful influences that it must inevitably and in every case exert.

V.

VACCINATION, SMALL-POX, AND INFECTIOUS FEVERS.

A REPORT ON LAWS, SANITARY PROVISIONS, AND METHODS FOR SECURING THE BENEFITS OF GENERAL VACCINATION THROUGHOUT THE COUNTRY.

By ELISHA HARRIS, M. D.,
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PRESENTED AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

A GREAT master in the science and duties of public health care has said, after studying the experience of all countries in vaccination and the prevention of small-pox, "Surely no principle can be more obvious than this, that if the State professes to vaccinate the people — above all, if it compels the people to be vaccinated, it must take every possible security for the excellence of the vaccination which it offers. A local prejudice against vaccination, would, in my judgment, be a reason for inquiring into the skill with which (in the prejudiced locality) vaccination has been administered." [1]

The greatness and value of Dr. Jenner's discovery of the specific preventive of small-pox will never be successfully controverted; but the policy, the methods, and laws of public health governments and local authorities respecting officially-supervised administration of this prophylactic against a dreaded Destroyer will continue to be discussed until science supplants charlatanry, and until the popular knowledge of hygiene shall have superseded ignorance and prejudice. Such discussions will be equally earnest and useful, whether they refer to the obligatory and compulsory, to the gratuitous and regulated, or to the optional methods of administration of this preventive measure; for by the study and experience of each of them we may reasonably expect to find, within proper limits, that each of these methods must be provided for by a system of public health laws worthy an enlightened people. The claim that vaccination is competent to exterminate small-pox, or, at least, wholly to protect the human race from this loathsome contagion, was from the first contested by skeptics, and is even now confronted by the crotchets of illogical and captious men; yet this verdict of science and sound medical opinion has been made up upon the basis of the

[1] *Papers relating to the History and Practice of Vaccination in England.* By John Simon, Medical Officer to the General Board of Health.

experience of millions on millions of facts, and the observations of the best medical minds in the world. Previous to the discovery of this boon, small-pox had for centuries continued to destroy from one tenth to one fourteenth of all who were born; but when after thirty or forty years' experience of the protective influence of vaccination, the immunity of the vaccinated, and the ready limitation of the pestilential spread of the disease, equaled all that had been promised concerning the vaccine prophylactic, the advocacy of *compulsory* methods, and the most imperative laws for administering them, became occasionally vehement and unreasonable. The experience of all civilized countries during the past seventy years, shows what is found to be practicable and most useful in regard to the interference of the State and local sanitary authorities to secure the vaccination of all children.

It is our purpose, in this report, to submit the conclusions which the best experience and the acknowledged wants of communities give as the basis for the laws, sanitary provisions, and methods by which the largest benefits of vaccination shall be secured throughout our country.

Official Interference. — Preliminarily to our examination of the questions relating to vaccination laws, the axiomatic truths concerning the conditions necessary to good vaccination and the exercise of official sanitary interference in respect of it, need to be recited in brief terms; for while the plainest principles of social and political economy may fully warrant the enactment of whatever laws are requisite to prevent pestilential diseases, the prevention of small-pox is secured only by a kind of interference with the individual, which must first be justified upon the ground that the safety and welfare of mankind demand it; and, secondly, that the laws and all proceedings under the laws are so applied as to do the individual no harm, and at the same time secure to each person the most complete protection from this contagious pest on account of which such obedience to a sanitary duty is rendered. The following are the most essential conditions in this view of the personal and public interests: —

That the quality of the vaccine lymph shall be absolutely perfect, and that the insuring of this uniform excellence shall not be permitted to be subject to uncertainty or any kind of capricious judgment.

That no barriers of poverty, ignorance, or the inaccessibility of means shall prevent the administration of the vaccination which each child needs.

That every parent and custodian of children, and every other person susceptible to small-pox, and every medical practitioner shall, by timely and adequate provision of the State and local sanitary authorities, be wholly without excuse for failing to have conveniently accessible the needed supply of perfect vaccine virus, and whatever is essential in the nature of information, instruction, and a personal record.

That whatever is ordered or required by the public authorities to be performed in respect of vaccination, the laws should enable and require the same authorities to insure being performed, and should give to the people as well as to the authorities such necessary means of information and instruction as shall suitably prepare them to understand and perform their duties.

In the four conditions that are here stated to be necessary for universal and satisfactory success in vaccination generally, and as a public as well as a private duty, the fact is assumed that the best of vaccine material, the sanctions under which it is supplied for public use, and the kinds of information and instruction which may frequently be required by the people and by local authorities, in order to extend the benefits of vaccination to all who need, will be duly kept in view as essentials to be secured in the operation of adequate laws and methods, and by sanitary authorities which provide incentives and means for general vaccination.

Laws to provide for and enforce Vaccination. — Vaccination in the United States hitherto has been chiefly an optional or a charity service. Compulsory and obligatory laws and sanitary ordinances have rarely been carried successfully into operation. In the State of New York, a compulsory statute has for eleven years remained a dead letter in the General Statutes. It was made applicable to every school district in the State, and was left to execute itself. It has not been applied in a town or district, and has the present autumn (1875) been fanned into life in a single small city, only to discover its utter inadequacy, for it reposes in school-boards the duty of providing for and conducting public and mandatory vaccination, and of assessing the cost thereof upon the tax-payers. This contagious pest, which requires public provision for universal vaccination, is indisputably a destroying enemy of mankind, and ever to be kept under the surveillance and control of public health authorities. General vaccination and public provision for its most expert and universal application, is a duty of sanitary government, and rightly subject to any needful regulation by statute, because just so far as it is faithfully applied, vaccination is the preventive of small-pox. Unfortunately for the human family, there are no other pestilential diseases which are proved to be preventable by the operation of a harmless substitute; therefore, all laws and provisions for general vaccination stand alone, and relate solely to the prevention and control of the one loathsome and dreaded contagion of small-pox.

Vaccination being designed solely to *prevent small-pox* and to render its pestilential prevalence impossible, and the actual value and efficiency of vaccination depending directly upon the watchful supervision of the vaccine material, the prevention of errors and impostures, and the maintenance of perfect standards of virus, and of practice in this service, — the proper medical and State authorities are certainly in duty bound to take cognizance of all the conditions necessary to secure perfect vaccination and to control and prevent the prevalence of small-pox.

Systems of Vaccination. — These may be termed: The Optional (whether by private or public provision); the Charitable; the Obligatory or Compulsory.

Of the vaccinations under the second and third provisions, it is possible to preserve complete records, adapted to develop the desired knowledge of the whole subject of vaccination; and wherever the public authorities render aid and counsel to those who give or accept the optional kind of vaccinal service, the local sanitary authorities and the individuals so vaccinated

by competent persons of their own or their families' selection should have an authentic record. This plainly indicates the necessity for a system of public registry of vaccination. The registry cannot be made satisfactory or as valuable as it should be, without a system of official inspection of vaccination, and such a system must not be allowed to degenerate into an unskilled service, but must ever be an expert and most painstaking duty. As Mr. Simon has well said, "What has to be administered is not a mechanical matter of routine and registration, but a system which, from beginning to end, and from centre to circumference, requires in all its parts to be vitalized by the *science of medicine.*" Let this pithy sentence be the motto for all official and professional workers, under whatever laws and regulations States and communities may adopt concerning public vaccination; and be it remembered that to prevent a dire pestilence — which springs from a contagion that destroys multitudes of precious lives in every country, and disfigures those whom it does not kill — is the sole reason for vaccination; therefore, that the laws and methods to provide for vaccination are simply and emphatically the barriers which entire communities and countries erect against a most dreaded enemy. In none of the States of our country is there a system of faithful registration of the individual vaccinations. A very useful old law relating to the vaccination of school children in the State of Massachusetts was long ago repealed; and the statute in New York requiring the certified and registered vaccination of all pupils in the public schools, has remained a dead letter, except in so far as the sanitary and school authorities, acting together in the cities of New York, Brooklyn, Elmira, and Rochester, have secured a partial compliance with the statute.

The successful registry of the vaccination of all the children born in any State must depend mainly upon the public registration of all births; the system of birth-registry being taken as the basis of the system of notification, instruction, and following up to secure the vaccination of every child. The English, Scotch, Belgian, French, Prussian, Italian, and most others of the European systems of public vaccination, are based thus upon the State system of birth registration. Though these European systems of vaccination and the public registration are spoken of in the United States as being compulsory, they are so only in a comparative degree, while the very best of them are simply instructional and obligatory, the legal proceedings *in the nature of compulsion* being resorted to *only as a last alternative.* This is as it should be, especially if skill and the most perfect qualities in the vaccinal service are not publicly offered in every community; and when such completeness and perfection in this branch of the public health-service shall have been secured in any State by a wisely ordered system of central and local authorities which shall provide only the best vaccination and the most skillful supervision of it, — then the necessity for compulsory proceedings will rarely, if ever, occur. Compulsory judicial action to overcome obstinate resistance to the duty of submitting to vaccination, occurs only as the unfortunate outcome of prejudice, ignorance, or of unreasonable modes of considering the duty of vaccination. Mere prejudice, that has resulted from reported and exaggerated accounts of some accidental evil which has fol-

lowed some careless kind of vaccination, is the chief source of opposition which sanitary authorities have to confront. But such prejudice cannot be overcome by arbitrary compulsion, even in the instances in which the security of a community and the performance of a public duty require a compulsory vaccination of a particular person, or group of persons. Justly does the chief medical officer in England say, "A local prejudice against vaccination would, in my judgment, be a reason for inquiring into the skill with which, in the prejudiced locality, vaccination has been administered." This statesman among sanitary authorities, while acknowledging the importance of obligatory or compulsory laws for vaccination, declares, from the largest experience and responsibility, that, "While the law provides a specific machinery for public vaccination, offering it gratuitously to all persons; and still more, while the use of this very machinery is, in fact, for two-thirds of the people, not optional but compulsory, so long I hold it is a moral obligation on the part of the state, that what it thus invites and compels people to accept, shall be of at least good quality." If vaccination is an unqualified blessing only when skillfully administered, if prejudice and resistance against it are the outcome of faultiness and indiscretion in the application of it; and if the universal and almost unexceptional vaccination of the entire population in any State or city can be secured by means of special expertness and tact of skillful medical and sanitary officers, then a resort to legal prosecutions certainly should be only a *dernier ressort* for overcoming any particular wanton resistance to the law. Experience warrants the conclusion that excepting at the times when small-pox is invading a community, and in the rare instances of wanton recklessness, actual compulsion by legal proceedings, by penalties, etc., may not be expedient, and that even the mandatory language of compulsion is unnecessary; for in the few persons, and the extremely few parents who obstinately resist and scorn the offer of vaccination for themselves or their families, such abnormal and vicious obstinacy is made angrily uncontrollable by the bare assertion of force and authority. Says one of the best interpreters of sanitary authority in the administration of public vaccination, when fully supported by a compulsory law, "kindly consideration for people's feelings, often a little coaxing, sometimes a little authority, always a good deal of discretion, are — if he [the vaccinating physician] is to reach his utmost utility — as necessary to him as his lancet."

The best examples of success in enforcing universal vaccination are presented in those countries which in the largest degree provide instructional and very perfect methods for securing the best quality of lymph, and the most appropriate seasons of the year for general vaccination of infants and others. We need only quote such examples as those given by Scotland, Belgium, Sweden, and Prussia. Not only are ample and well-adapted facilities afforded for the gratuitous vaccination of every child in the realm, but, after notification, instruction, and admonition, the statute begins to be compulsory only after a year has expired. In Sweden, two years are allowed to elapse before compulsory proceedings are enforced; and in Belgium, where compulsion is only indirect by affecting privileges of individuals, and

recognizing the public as well as personal value of protection given by vaccination; that kind of indirect compulsion being the most important and practicable, while it is far the most convincing and effective of moral agencies to induce a popular willingness and desire for vaccination among the masses of the people, we should not fail to resort to these indirect means, even if the laws and machinery of the health government were to provide mandatory requirements and prosecuting officers to compel the vaccination of every individual in the State, or in a particular city. Be it understood that in presenting this aspect of public duty, the utility of a compulsory law, with coercive penalties, to be applied by competent sanitary and judicial authority, in exceptional cases, is not brought into doubt. What is here shown, is the fact which all experience teaches, that instructional means, optional, regulated, conditionally gratuitous, and indirectly compulsory measures should be everywhere provided as the chief agencies for procuring the vaccination of the people, and should precede the actual coercion of the duty by fines, penalties, or disabilities. Though it may not be proper for the medical officer of health to define the limits of the domain of sanitary law or the doctrines of State interference with individual privileges, the experience of municipal sanitary officers sustains the principle and the proceedings in the practice of vaccination as herein set forth.

The author of this report is as earnest an advocate of the obligatory forms of public law and authority respecting vaccination as any sanitary officer or physician can be. But with this confession of personal allegiance to an obligatory form of public health law and official practice in respect of systematic vaccination, including the inspection and record of every child's vaccination, all experience justifies the language of the sanitary statesman, Mr. Simon, "that no principle can be more obvious than this; that if the State professes to vaccinate the people, above all, if it compels the people to be vaccinated, it must take every possible security for the excellence of the vaccination which it offers." The necessity and best reason for State interference, both for the provision and the enforcement of vaccination, will be found, in most places, to consist in the fact that there is a vast amount of spurious vaccination, and that the interference of the State and of the local sanitary authorities is quite necessary to prevent such deceptive and injurious results. This not only is strictly true, but it is a most momentous truth, important for the people to understand.

The registering, the inspecting, and the certifying of vaccinal results, as found to be well authenticated in every child year by year, and within the first year or two of childhood, in every community and under sanctions of State laws and the most expert medical judgment, must constitute the foundation of a truly compulsory system, if that or any obligatory system is to be rendered successful; and if a State hesitates to establish a public system of vaccination, all the more is it important that the means of maintaining the perfect standards of, and ready supplies of, vaccinal virus shall be provided by State authority, or an adequate provision for perpetually encouraging the maintenance of the best quality, and an ample supply of vaccinal

lymph. The latter view of the duty of a State has prevailed in Maryland.[1]

In the absence of a State Board of Health in any State, this example of the State of Maryland may be usefully followed; or the Board of Health of the chief city in each State may be required, by statute, to maintain and dispense the standard stock of vaccinal lymph, as the State of New York now requires, or rather permits, the Health Department of the city of New York to do, under special statute.[2]

But this dispensing of perfect vaccine virus is not alone sufficient for securing the chief result which each community ought to secure in regard to public provision in vaccination. If the State has the right to interfere in any way to secure the public benefits of vaccination for the prevention of small-pox, then certainly the same authority should extend to the prevention of imperfect, deceptive, spurious, and injurious kinds of vaccination. Though there may be some exceptions and limitations to the power and means to prevent spurious and imperfect kinds of vaccination, which result chiefly from ignorance and inexpertness on the part of the vaccinators, there is ample reason why a State, as well as every community, should wholly prevent midwives, old women, druggists, clergymen, amateurs, and all other persons than the legally qualified physicians and such non-medical men as shall be specially instructed and licensed for this duty, from offering their services as vaccinators. What is called vaccination, is, in a vast number of persons in the United States and the rest of the world, only so in name and not in reality. As Mr. Marson has said concerning vaccination in England, so in the United States: "All persons — amateurs, druggists, old women, midwives, etc. — are allowed to vaccinate in any way they may think proper, and the persons operated on are considered to have been vaccinated." The so-called prejudices against vaccination will continue to hamper the public administration and full benefit of this prevention of small-pox, so long as such faults exist.

Turning now to the question of established systems, how plainly it appears, that however imperative and compulsory the statute or sanitary code may make the duty to vaccinate every child, and revaccinate or test the sufficiency of the vaccinal safeguard in every person in the community, the mode of administering the vaccination laws must be instructional, persuasive, convincing, and in every possible way associated with the idea of self-interest, social and public duty, whether there be penalties and fines awarded by law to the parents, guardians, and persons who obstinately and wantonly refuse to submit to its requirements or not. Experience, in all countries

[1] The State Agent of vaccination, located in Baltimore, Md., has proved the practical utility of the central depot or conservatory of vaccinal material of the highest standard of quality. Almost every town and hamlet in this State has had occasion to procure fresh lymph from that Conservatory.

[2] The Health Department of the City of New York was authorized and directed by an Act of Legislature (chapter 635, Laws of 1874) to organize a corps of vaccinators and establish a conservatory and dispensary for vaccine lymph or virus under the control of the Bureau of Sanitary Inspection. This Bureau is required to provide for necessary gratuitous vaccination and to collect and preserve pure vaccine lymph for regulated distribution.

where the masses of the people are better vaccinated than in others, as in Sweden, Prussia, Italy, France, Belgium, and especially in Bavaria, Hanover, Frankfort-on-the-Main, and in numerous cities and small states, in which the recognition of the private and public obligations of timely and general attention to vaccination is universal, and the duty is best appreciated and has produced most complete results — shows that the instructional and the indirectly compulsory methods are patiently and exhaustively applied before direct coercion, fines, and disabilities are resorted to. The ultimate necessity and right to resort to the latter extreme measures, is undoubted among the useful agencies by which common minds are influenced to adopt the optional method of complying with the duty of vaccination. To undertake, by mere force of law, the compulsory vaccination of every new-born babe, without some conference and reasoning with the parents, and without first providing perfect modes and means for the vaccination of every child in the community and in the State, is not expedient nor entirely practicable. But the reason and self-interests of the people can be aroused and enlightened so as to compel inquiry and secure the spontaneous assent of the judgment. It has been found that in those European countries in which a verified and registered account of every person's vaccination is kept, there is the largest success in applying the laws of compulsion, and still more of inculcating the consciousness of obligation in regard to vaccination. In Austria, for example, the vaccinating physician patrols his appointed district several times a year, and whoever refuses the officially-approved vaccination which the law requires, is denied every kind of public charity — the vaccinating officer's certificate being necessary to the public allowance of any aid. Admission to any school, any public service, or office under the government, depends also upon the vaccinator's certificate. In France, we find the same laws in operation; and perfect practice of vaccination, as a branch of public hygiene, is encouraged by prizes and other rewards. Sweden has also brought all the resources of instruction, official inspection, and encouragement and indirect compulsion to bear upon the people, until that country is absolutely secure against small-pox. After two years of patient effort to induce obstinate parents and custodians of children to accept vaccination, if still they object and resist, the magistrates begin to apply fines and penalties. The German States, and particularly the (former) "Free Cities," have completely demonstrated the practicability of the *instructional* and obligatory system thus combined, and they seem to have proved that the greater the predominance of the instructional element, and the more completely that element overshadows and constantly accompanies and explains the compulsory requirements of the public system of vaccination, the larger and more satisfactory will be the results. In England and Wales, under the laws which have gradually reached their compulsory stage, there is continually increasing proof, that the instructional, persuasive, and obligatory provisions of the public laws should be so blended that they shall be administered without arousing prejudice. The Anti-Vaccination Leagues, and the definite resistance to the vaccination laws in Great Britain the past year or two, might have been prevented by blending a larger share of instruction

and persuasion with the authoritative duties of the district vaccinators. Scotland, under the Vaccination Act of 1864, has achieved the greatest success of any portion of the British dominions, in the public and private vaccination of the infant population, for more than ninety-four in every one hundred infants born alive, are successfully vaccinated during the first year of life. Six months of delay from the birth of a child, is allowed by the Scotch statute for the optional, the gratuitous, or any ordinary way of private or public vaccination; but experience has justly induced the government authorities to petition the parliament to reduce the period now permitted for compliance at discretion with the law, from six months to four. This is demanded by the sanitary officers, because about three per cent. of the infants of Scotland fail to be successfully vaccinated. The law of Scotland has produced the most perfect results witnessed in any part of the British dominions, and because of such preëminent success, and of the general fitness of the chief portions of the Scottish Vaccination Act to the wants of our American States, its successful operation is thus particularly mentioned.[1] Yet the fact is noticeable in every country, — and it would be in different States of our own country, — that the best possible adaptation of a system of public vaccination in any one State, may not, in all particulars, be adapted to the laws and methods of sanitary administration in another.

The very effectual results of the obligatory vaccination laws in Scotland are evident from the fact that small-pox has become nearly extinct in the child-population of that country, and that less than four out of every one

[1] At the end of the year 1873, the tenth of the operation of the Scottish Vaccination Act, Dr. Wm. Robertson, Chief of Statistical Bureau under the Registrar-General, reported the following facts: —

Average annual number of births in Scotland in ten years, ending Jan. 1st, 1874	114,935
Died or removed before vaccination could be enforced under the law	12,490
Postponed by medical advice	811
Insusceptible from various causes	581
Total number whose vaccination should be accounted for, after foregoing explanations	101,152
Average annual total successfully vaccinated	**101,152**

The Report states: —

The number of children born in Scotland during the year 1873 was	119,810
The number successfully vaccinated was	105,177
Operation postponed on medical authority on infants	1,113
Number of infants insusceptible	364
Number of infants that died before the lapse of the statutory six months	10,527
Number of children that moved out of the district before the lapse of the statutory six months	2,629

Number of children living to the age without successful vaccination, two and four tenths per cent. of all the infants who survive that age.

The Report states further: "In Scotland there is but little of that unreasonable opposition to the practice of vaccination by which some opinionative men are elsewhere moved. But the greatest enemy to the practice is, in Scotland, the habit of procrastination existing among the lower classes of society. This habit, it is feared, prevents many parents from applying to the vaccinator, till a reminder from the Registrar has been issued, requiring them to have their children vaccinated. Such reminder is not issued till near the close of the sixth month after the registration of a child's birth."

hundred infants which survive six months from birth fail to be well vaccinated. The aggregate experience in the vaccination for the first ten years of the operations of the Scottish system is summarized as follows (in percentage form, after giving the statistics in detail), by Dr. Robertson, the chief of the Statistical Bureau of the Registrar-General's Office, — this summary being based upon 1,251,287 registered births.

	Successfully Vaccinated.[1]	Vaccination postponed.	Insusceptible of Vaccination.			Removed from District before Vaccination, or otherwise unaccounted for.	Total Living.
			From Constitutional Insusceptibility.	From having had Small-pox.	From previous Vaccination.		
Ten years ending December, 1874. Percentage . .	96.184	0.772	0.282	0.051	0.220	2.491	100.00

The postponement of vaccination under medical advice, and no small number of the cases of insusceptibility experienced in the operation of the Scottish system, occur between the fourth and seventh months of infant life. Nearly all of the failures to vaccinate, because of removal of infants, occur in the nomadic class, that most of all should receive the earliest possible benefit of obligatory vaccination. The sanitary authorities, therefore, have very prudently urged upon parliament, the duty of reducing the optional period for vaccination to the limit of the end of the fourth month from birth. Dr. Robertson states that, "The most frequent cause of these postponements is the indisposition of the child in consequence of some of the infantile disorders connected with teething. Now if parents and guardians could be induced to have their children vaccinated before the completion of the fourth month of life, a most fruitful source of postponements would at once be removed. But it is to be feared that, at all events among the poorer classes, there exist habits of procrastination, which induce them too often to take no steps to have their children vaccinated till the last legal moment, and to wait in fact till they receive a statutory reminder from the Registrar, calling attention to the penalties which further delay will occasion. In such circumstances it is believed that no small number of children six months old are presented for vaccination, and in consequence of the presence of some teething-rash or other infantile complaint, are judged not in fit condition to be subjected to the operation of vaccination, and hence tend to swell the list of 'postponements.' It is quite plain that by curtailment of the period during which the vaccination of children is not obligatory, almost all the postponements that are at present due to the disorders connected with teething might be got rid of; and, were it merely in order that postponements should become less frequent, we should be disposed to advocate the period

of four months as the maximum during which a child should be permitted to remain unvaccinated."

Experience has shown that in the absence of a thoroughly efficient system of birth registration, the steady maintenance of an effectual system of public vaccination is simply impracticable. The special want of this essential collateral and essential aid, as a preliminary record and directory in public vaccination, is so obvious in all the United States and Canada, that it should induce a general effort to procure an effectual system of registration of births in every State. The requisite conditions for giving full effect to any good system of public vaccination will not be complete without the faithful registration of every child within sixty days from the birth. Even in the administration of the Scotch Vaccination Law, it has proved seriously at fault in its unreasonable limitation to only the children born in Scotland. The practical import of that limitation may be witnessed in contiguous States and neighboring cities, within which there is great difference of degrees of completeness in the birth-registry, whatever be the system of public vaccination. The cities of Providence and New York vie with each other in the effort to secure the vaccination of all their young children, but Providence has the special advantage of a perfect registration of its newly born, the records for which are gathered in periodically by house-to-house canvassers; and the sanitary system of that city also maintains a central service for gratuitous vaccination every Saturday in the year. Therefore the superintendent of public health is able to know at frequent intervals if any children remain unvaccinated, and as the official certificate of vaccination is required of every school child, the protection against small-pox distinguishes that city. Says one of the medical practitioners — whose notes on the sanitary state of his country will be found in another report in this year's transactions, — "for a period of over forty years small-pox has appeared among us in a clandestine way a number of times, but not in one instance has it been permitted to overreach the first cases, because those initial instances of the contagion were isolated from all unprotected persons, and the household and neighborhood subjected to vaccination and re-vaccination." Thus is demonstrated the benefit of vigilance and vaccination in a populous town. In this instance the scrupulous care of a great physician, whose opinion and decisions have had all the moral force of law and official regulations for forty years, protected an inland village and populous town from small-pox; but now, with the increase of population, and an attendant impossibility to know that all the children are vaccinated, the venerable physician closes a recent letter to this Association appealing for the thorough registration of vital statistics in every State as an essential part of the basis for a public health system. Effectual defense against small-pox will not be permanently maintained in any state or city without the aid of a faithful system of registration of vital statistics.[1]

[1] Numerous instances of complete success in preventing small-pox through many successive years, can be quoted, and a single illustration suffices: "In the parish of Mold in Flintshire, North Wales, the population is greatly exposed to small-pox by constant communication with Liverpool and other places in which that disease always prevails; but the dis-

With the desire to give the most practical direction to the information contained in this report, and to incite useful action to promote vaccination throughout the country, we submit the following

CONCLUSIONS.

First. — All experience, from Jenner's time until now, proves that vaccination requires skill and carefulness, and demands exact knowledge and practical instruction in the art of its application.

Second. — Tact in the instruction aud persuasion of the ignorant and prejudiced, the greatest skill in vaccinating, the faithful observation and record of results, the exercise of good judgment concerning the quality and perfectness of the operation and its results, the faithful testing (by Bryce's method or a revaccination) in every case in which the sufficiency of the vaccinal operation may be reasonably doubted, and, finally, the systematic registration of vaccinated infants and all older children in our country, are essential requisites in the system for securing a trustworthy and universal protection against small-pox.

Third. — That, inasmuch as even these protective measures cannot be secured in any city or State without the accessory facilities which a State system of registration of births must offer, all experience shows that a judicious system of medical and official notification and instruction to parents, when supervised by competent minds, becomes one of the most effective agencies in securing the timely and cheerful compliance with the duty of vaccinating every infant. The Scottish, English, French, and German laws and official methods for securing vaccination of infants, are complete examples as respects the system of procedure in providing for public vaccination ; but the faultiness in the qualities of the vaccinal virus employed, the frequent carelessness of vaccinators, and the want of adequate instruction to parents and the care-takers of children, are great drawbacks upon the success and popularity or acceptableness of obligatory vaccination. These circumstances need not be drawbacks in our American States, if we infuse and vitalize the vaccinal system which shall be adopted with the instruction and inquisitive criticism which the American people are wont to give to matters of public sanitary duty.

Fourth. — The encouragement of official supervision of the supply of vaccine lymph, which shall be kept continually under a system of registered observations and testing for the maintenance of the perfection of its attributes, is plainly a duty of the first importance ; and wherever a State Board of Health is formed, or a municipal sanitary board is endowed with sufficient authority and means, it should maintain or at least supervise such a system of vaccinal lymph supply. It is by no means necessary to wait for

trict vaccinator, Dr. Hughes, has made it an invariable rule to permit no infant to remain unvaccinated. In the fourteen years ending Sept. 30, 1867, 7,654 children had been born and vaccinated in that parish; and that faithful vaccinating officer states, that the result is that ' No child born in the Mold district, and alive at the date of the registration of its birth, has died of small-pox during the fourteen years.' " [See original statements in Seaton's *Hand-Book of Vaccination*, p. 259.]

the organization and development of a complete sanitary system, nor for the perfecting of birth registry, before providing a perfect standard and a public supply of vaccinal lymph.

Fifth. — In the United States, it should be regarded as entirely possible to so frame obligatory laws and regulations for general vaccination that they shall provide for adequate instruction and the best safeguards to secure perfect vaccination. The laws for the purpose, the rules and methods of administration under the laws, even when compulsory, can and should be so ordered as to avoid the needless incitement of ignorant prejudice and wanton opposition.

Sixth. — State Boards of Health and the sanitary authorities in each city and town of the respective States may greatly expedite the operation of the laws and regulations for general vaccination, by uniting in efforts to secure ample diffusion of correct knowledge concerning the merits and duty of vaccination among all classes of people, and by providing methods for supplying perfect vaccine virus and an effective system of practical instruction in vaccinating.

Seventh. — Regular vaccinating days at intervals of one week are established by all experienced public vaccinators and by the best family physicians for the duty of inspecting every vesicle and vaccine at the expiration of seven days precisely ; the importance of facilities on particular days for fresh lymph and arm-to-arm vaccination with it, as well as the practical relation of habit and regularity in any duty or service which is liable to procrastination or neglect, require that in every city and town, the public health authorities, or the medical profession, shall see to it, that on a designated day and hour and in suitable places, the public vaccination shall be offered. In like manner, medical practitioners, — especially when serving the poor, — may greatly facilitate and insure the best results of the duty they owe to families, by designating one day in the week for replenishing their own stock of vaccinal virus, inspecting every vaccinated person of the previous week, and vaccinating others then requiring it. Vaccinating days and the seventh day inspection must be regarded as essential to the success as well as to the general popularity and universal application of vaccination.

Eighth. — Vaccination is so truly within the domain of medical science and practice, that no official and public system, however compulsory it may be, can wholly supersede the duty of family physicians in the vaccination of families of the more intelligent classes ; and for this reason and for awakening a scrupulous concern of physicians for the maintenance of perfect means and efficiency in private as well as public vaccination, the official method relating to the subject needs to be adopted to secure mutual efforts on the part of the family practitioners and the sanitary authorities to render the protection against small-pox universal and perfect.

Ninth. — An experience in various countries now proves that a state or a nation may justifiably require that in all departments of public employment, in which there is such liability to the contagion and dissemination of small-pox, as would embarrass the public service or injure the people, it should be an established rule of all official and subordinate service in that depart-

ment, that each individual shall present certified testimony of vaccination, or the other protection against small-pox.

Tenth. — In all schools, colleges, universities, penal and reformatory institutions, asylums, and factories, there should be an established rule, requiring that every individual therein present certified evidence of vaccination, or the other protection against small-pox.[1]

Eleventh. — Experience in the best-governed States and cities, altogether confirms the correctness of the principle and practicability of the laws which require that such rules as we have specified under the last two preceding conclusions should be supervised by sanitary authority.

Twelfth. — Obligatory vaccination is not in danger of becoming odious to the people, if the law and the practice under it provide for perfect accuracy in the operation itself, for the maintenance and care of perfect standard vaccinal lymph, for the critical observation of results in its application, and for maintaining a system which, as Mr. Simon truly says, "from beginning to end and from centre to circumference requires in all its parts to be vitalized by the science of medicine." In maintaining such a system of obligatory vaccination, the conclusion of Mr. John Stuart Mill, in regard to "the limits of the province of government" aptly applies: that "when a government provides means for fulfilling a certain end, leaving individuals free to avail themselves of different means, there is no infringement of liberty, no irksome or degrading restraint. One of the principal objections to government interference is then absent." The means, the motives, and all needed instructions can so prepare the way for the duty of vaccination that universal obedience to the public laws concerning it will be promptly rendered.

[1] This conclusion has its legitimate corollary, that so far as re-vaccination is important as a means of public security against small-pox, or so far as essential even in schools, it may justly be required. The duty of applying the sanitary rule of vaccination in all the schools of a city and seeming universal approval of it by the people, have been illustrated these past few years in the city of Elmira, N. Y. A medical member of the Board of Education so completely explained the duty and arranged the official part of the service that all difficulties vanished. A Sanitary Inspector of Schools verifies and records the vaccination of the pupils.

DISINFECTION IN YELLOW FEVER AS PRACTICED IN NEW ORLEANS IN THE YEARS 1870 TO 1876 INCLUSIVE.

EVIDENCE OF EFFECTUAL SANITARY RESOURCES AGAINST THE SPECIFIC CAUSES OF THE FEVER.

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The marked localization and very limited range of action of the cause of yellow fever are universally recognized facts.

Wilson, quoted by La Roche, writing of the epidemic on the *Rattlesnake,* states that these characteristics of yellow fever poison were "most strikingly exemplified in the berths of the midshipmen and officers of that class. They were placed exactly opposite each other, with the pumps at equal distances between them. One gentleman was affected in the starboard berths, while every member of the larboard berths was laid up at nearly the same time."

In 1822 the Board of Health of New York ascertained that the yellow fever of that year spread at the rate of forty feet per day.

Dr. Nott says of the Mobile epidemic of 1842 and 1843: "In 1842 the epidemic began in the southern part of the city, in Spanish Alley, and swept one half of the city, stopping at Dauphin Street. The next year it began in the southern portion of the town, finished the remaining portion of the city to Dauphin Street, and again paused."

During the prevalence of yellow fever in the year 1856 on Governor's Island, New York harbor, in Rotten Row, an oblong, rectangular building, divided longitudinally by a thin board partition, those living in the south-southwest half of the building suffered most severely — scarcely one escaping — while perfect immunity from the disease prevailed among those living on the north-northeast side. The history of yellow fever affords numerous similar examples.

Reasoning from the method and range of action, and mode of propagation of yellow fever, its poisonous cause is evidently not gaseous in its nature. It seems to attach itself to the soil, to walls, and probably surfaces in general. If this poisonous cause be organisms, either animal or vegetable, they seem to be low lying, propagating from centres along surfaces, equally in all directions, against the wind as well as in the direction of air currents. It is also evident that the cause must antedate the effect; that the poison exists in activity some days before the moment of attack of yellow fever, as the period of incubation in most persons is four days, also

that the poison has existed in more or less force for an indefinite period preceding the precise moment at which incubation of the disease in the individual began.

It is also evident that at the date of the appearance of the case of disease, the poisonous cause is probably no longer confined to the narrow limits of the habitation or locality where the illness was contracted, but has extended to a greater or less distance into the space around it.

To completely destroy the poisonous cause, and thus arrest the spread of the disease, disinfection must, both in theory and practice, be applied to every portion of the suspected locality. It must be applied, so to speak, to sound surfaces, to a region beyond that where the poison is known or suspected to exist, in order to certainly prevent the spread of the disease. To approximately define the area to be disinfected, to the number of days the patient has been ill is added four as the probable number of days of incubation of the disease. This total multiplied by forty — the rate of travel per day in feet, which observation has furnished — is the radius in feet of the probably infected area. If, for example, the case have existed four days, from this case taken as a centre, a circle of three hundred and twenty feet radius is to be considered and treated as infected.

Disinfection is effected in dwellings and similar structures by sprinkling floors with carbolic acid, one part to fifty of water, wetting bedding and clothing thoroughly with the same solution, or by placing them in boiling water. Walls and ceilings are disinfected by a steam atomizer throwing a spray of dilute acid. When owing to pressure of work sufficient time cannot be afforded to proceed in this manner, sulphurous acid and chlorine are used. Sufficient humidity is always present in the atmosphere of New Orleans to render chlorine an exceedingly effective disinfectant. All open spaces about infected premises, yards, walks, alleys, and the part of walls next the ground, are freely sprinkled with carbolic acid.

The acid used has been — 1st, crude carbolic acid, manufactured in New Orleans, containing, according to analysis by Dr. Perry, never less than eighteen per cent. and usually twenty to twenty-five per cent. of carbolic and cresylic acids, and quite ill smelling from the presence of napthaline and tar oils. 2d. Calvert's No. 5 acid, a mixture of carbolic and cresylic acids, the latter predominating, but free from tar oils, and therefore frequently spoken of as pure acid. The acids free from tar oils are much less unpleasant to the inhabitants of a locality in process of disinfection; but it is highly probable that the crude acid, containing empyreumatic acids more energetic than the carbolic and cresylic and also oily and other substances preventing the immediate evaporation of the acids, is the more permanent and effective disinfectant.

Disinfection of infected localities by the coal-tar acids, may be conceived of as effected, if the cause of the disease be organisms, by the coagulation of their albumen; or to other deleterious influence exerted on their life or reproduction; otherwise, by the thorough and complete modification of the local disease — causing conditions, perhaps the presence of potential or catalytic albumen, which modification, by destroying the cause of the dis-

ease, or perhaps only preventing its further evolution, brings back such an infected locality to its usual state — practically identical with that of its immediate healthy vicinity where yellow fever has not appeared. Atmospheric disinfection is not proposed; the agent must be brought in contact with the poison or poison-producing or retaining surfaces, *in loco.*

It is evident that even with cordial coöperation on the part of the householder, disinfection cannot be effected with absolute perfection in an inhabited square. The disinfectant is, therefore, in addition to its application to the immediate locality, distributed upon the surface of the streets, both roadway and banquette (sidewalk), at a distance supposed to be entirely beyond the presence of the yellow fever poison, and in such manner as to encircle the fever centre by broad continuously disinfected surfaces. This is repeated at short intervals, to preclude if possible the passage of the poison across the belt laid down. Thorough, complete disinfection is then effected in every direction towards the center of the region thus circumscribed. The impossibility of complete disinfection of all surfaces in infected localities, under houses, etc., is evident; and the expression thoroughly disinfected, is therefore only relative, denoting the nearest attainable approximation to perfect disinfection.

It being never possible to secure absolute perfection of practical disinfection, total and immediate annihilation of the yellow fever poison is not usually secured, nor can it be expected. Its multiplication or increase seem, however, to be hindered, its force abated, and its march impeded.

It is easy to understand that if the cause of the disease be present by importation or otherwise very early in the season, at numerous points, and all climatic influences be highly favorable to its life and progress, that a general epidemic may occur in spite of disinfection. It may also be anticipated that if yellow fever foci appear somewhat late in the summer, and at comparatively few points, that the practice of disinfection will delay the spread of the disease until a decided fall of temperature, and subsequent continuous cool weather, put a stop to its progress and existence.

In connection with this part of the subject, the quarantine system in existence in Louisiana may with propriety be briefly considered. A quarantine system resolves itself into detention and disinfection. It is evident that in New Orleans, where the mean temperature for the months of June, July, August, and September, of the years 1873, 1874, and 1875, was 82.518, detention of ships, save for a period practically inhibitory of commerce, is useless. Favorable results of quarantine may with fairness be attributed to the measures of disinfection practiced. In general it may be stated that in the twenty-two years — 1855 to 1876 inclusive — in which the quarantine system and Board of Health have been in existence, three epidemics have occurred, the first of which was in 1855, the year of the establishment of quarantine; while in the twenty-two years previous to 1855 there were thirteen epidemics; and in the twenty-two years previous to 1833 occurred other thirteen epidemics.

The yellow fever of certain of these epidemic years is known to have been introduced from abroad in spite of quarantine restrictions; and since

disinfection has been practiced in the city with system and energy, the disease combated is certainly known in some instances to have been imported. But in 1874 Dr. A. W. Perry introduced at the quarantine station his process of disinfecting vessels by forcing into their holds, for several consecutive hours, by a power blower, sulphurous acid gas. Synchronously, disinfection of forecastles, bilges, etc., was effected by the plentiful use of the coal-tar acids. In 1875 and 1876 the additional precaution has been taken to re-disinfect all vessels from the tropics after being laid to their wharves in the city, and upon the discharge of their cargo. Hygienic rules for the government of ships on their way from tropical ports were issued in 1875, thus securing in those obeying them a practical "in transitu" quarantine. As conformity to these regulations shortened the period of detention at the quarantine station, certain steamers, and other regular traders, observed them with a good degree of care. In no vessel so treated has a case of yellow fever appeared during its stay in the city. These results seem to furnish evidence in favor of the efficacy of disinfection in yellow fever.

In 1870 yellow fever appeared late in August, spread rapidly, and was of severe type, the mortality being estimated at not less than thirty-three per cent. of those attacked. The late Dr. F. B. Albers, sanitary inspector of that portion of the city, a man of intellect, information, much energy and executive ability, carried out disinfection, as then understood, very thoroughly. The report of Mr. Crookes on carbolic acid in the cattle plague, suggested to Dr. Albers its use in yellow fever. No. 230 Chartres Street, is a tenement-house running through the block, containing thirty rooms, and at that date was occupied by thirty families, numbering one hundred and eighty-three persons, natives of Italy. Of these, forty-four took the fever; four sent to hospital, result not known; fourteen died, twenty-six recovered. Of the remaining one hundred and thirty-nine, ninety-two were known to be unacclimated. After the process of fumigation and disinfection, only two were attacked by the fever. The results in this case seeming unmistakable, disinfection was effected with still more energy and system, and the epidemic remained local, though a second focus of some magnitude appeared in another portion of the city. In Mobile, where yellow fever made its appearance the same year, and fully one month later than in New Orleans, and where disinfection was not attempted, the disease became a general epidemic, and swept over every portion of the city. Although the disinfection of 1870 seemed of great value, and to lessen the ravages of the disease, yet the true idea of disinfection had not been reached. It was after this experience and reflection upon the whole subject that the author of this paper arrived at the principles according to which disinfection has been practiced during the past four years.

In 1871 one case of yellow fever appeared in New Orleans in July, two in August, and in the first days of September the disease developed in epidemic form in the fourth municipal district. The spread of the disease was combated by disinfectants, and limited to a small portion of that district. Foci appeared in other parts of the city, disinfectants were immediately used, and the disease spread from none of them. The yellow fever of that

year was doubtless imported. Jackson, Natchez, Canton, and several other towns and villages suffered the same year with yellow fever, supposed to have been originally brought from Charleston, S. C. In every town and village in the south where this disease appeared at all, and where disinfection was not resorted to, it became a general epidemic. The total number of deaths of this disease, in New Orleans, in a population of 197,000, was forty-five.

The fever of 1872 appeared on the 28th of August, upon the outskirts of the locality infected the previous year. Disinfection was put in force, and the disease apparently thereby confined to comparatively narrow limits, and a total of eighty-three cases.

The history of the yellow fever of 1873, and the efforts made to control its progress, are especially interesting, as the theory and practice of disinfection was supposed to be better understood, the process effected more systematically and completely, and the prevalence of the disease here, far north at Memphis, also at Shreveport, and numerous points in Texas, showed that all the conditions favorable to the existence and spread of the disease existed throughout the southwest.

There is good reason to believe, as the first death by yellow fever occurred on the *Valparaiso* from Havana, that this vessel brought the disease to New Orleans, and was the source of the epidemic, which appeared in the immediate vicinity of the wharf where she lay. Disinfection of this locality, streets, squares, etc., was begun hesitatingly; and it was only when the disease had evidently spread to some distance that energetic, systematic, and unsparing use of disinfectants began.

From this focus, or subsequent to its appearance, foci developed in six of the seven municipal districts of the city, and in each of these in an epidemic form. In every instance the disease was confined to narrow limits, apparently stopped in its progress, and if not utterly destroyed in the infected localities, its ravages greatly diminished. In the first, second, and third districts of the city, cases occurred on sixty-six squares, and in eight of these cases occurred subsequent to disinfection. In two of the eight, the failure was certainly only apparent, the disease having been contracted elsewhere, or previous to disinfection.

In the fourth district, where the fever first appeared, twenty whole squares were disinfected, with subsequent cases upon five of them; twenty-five half squares were disinfected, upon five of which subsequent cases, ten in number, appeared.

The total population of fifty-nine infected squares	6,846
Liable to yellow fever	1,744
Total number of yellow fever cases	107
Attacked by fever before disinfection	95
Attacked by fever subsequent to disinfection	12

As fever is not necessarily contracted where the person is ill, but may have been caused by an exposure in another unhealthy locality, it is not impossible that some or all of the instances given as failures may be only seemingly so, owing to the impracticability of tracing the true origin of the disease.

In the fifth municipal district, thirty-four cases occurred on thirteen blocks. In eight squares, no cases occurred after disinfection. In four of the five other squares which had been but partially disinfected, cases occurred on undisinfected premises. Only one square a failure, a case occurring twenty (20) days after disinfection. The disease may have been contracted elsewhere; or, upon the germ theory, the poison may have been partially reproduced by the multiplication of the organisms which escaped destruction. At the breaking out of the disease in this district, the roadway of the streets bounding a portion of it about four squares by seven, was liberally sprinkled with crude carbolic acid by street sprinklers. Cases occurred on eleven of the twenty-six squares included, but none originated outside of this locality in the fifth district (Algiers, on the west bank of the river). Total population of this included area, 1,352; liable to yellow fever, 226; cases of the disease, 26.

In the sixth municipal district cases occurred on twelve squares, with one seemingly partial failure of disinfection.

The total population of all the squares in which yellow fever appeared was 17,614; liable to yellow fever 4,237; total number of cases 388.

It is to be considered that this disinfection was largely made during the first days of September, at which date the disease was at its height in Shreveport, was rapidly nearing its maximum at Memphis; and subsequent to which date the disease appeared, and ran its course as an epidemic in many towns of Louisiana and Texas. It is evident that the general epidemic tendency or constitution of the year, if there be such a thing, had not yet passed away. In 1873, Pensacola, and Montgomery also, suffered with epidemics of yellow fever. It is evident, from the census of population taken, that the failure of yellow fever to spread in New Orleans that year did not arise from lack of human material upon which to exercise its malignant energies. Galveston escaped an epidemic that year. The late Dr. Geo. W. Peete was familiar with the New Orleans system of disinfection, and approved it. In 1873 he carried it into effect at Galveston, and says of the result: "In this city there were twenty-eight or nine cases of yellow fever that I knew of, and perhaps a few that I had no clue to. After the results of isolation and disinfection in the first four cases had fortified my belief that its dissemination could be controlled, I gave myself but little solicitude, and made no attempt to obstruct intercourse with interior localities infected from Shreveport, where it was prevalent; and hence most of the cases (seventeen of them) were clearly traceable to this source; that is, they were introduced from the interior towns of Texas, where the disease prevailed."

The yellow fever of Memphis in 1873 was derived from New Orleans. The disinfection practiced there need only be mentioned. I quote from a letter of Dr. Erskine, President of the Board of Health: "I did not enter upon duty as president of the Board of Health until about the 10th of October. The disease had then prevailed more than three weeks as an epidemic. Carbolic acid had not been used up to that time. We commenced the use of it about the middle of October; were unable to obtain carbolic acid sooner. By that time the disease had extended itself all over the city.

I do not think we had a fair trial of it; in fact, we used it very little. I should like to see it tried more thoroughly." The fact that water extinguishes fire is not invalidated if a city on fire at hundreds of points be totally burned. The experiment of New Orleans, in 1873, both positive, and as compared with that of other communities where disinfection was not used, is, therefore, decidedly favorable to disinfection.

In 1874, a few cases of fever appeared, disinfection was energetically practiced, and with apparent good results. Pensacola and Pascagoula, where no sanitary precautions were used, had yellow fever epidemically that year.

In 1875, six foci of infection appeared. In the first, which made its appearance in the second municipal district, owing to misapprehension of orders and the concealment of the second case, and opposition from the inhabitants of the locality caused by the ignorant prejudice of certain physicians, disinfection was not effected sufficiently early, nor to sufficient extent, nor with continuous completeness, yet the disease by roadway and banquette and such other disinfection as could be effected was almost entirely confined to a locality four squares by five, and to a total of forty-one cases.

In other foci, disinfection was carried out according to theory, and the immediate arrest of the disease followed the procedure. In the fourth district, early in September, seventeen cases appeared in two areas near to each other, somewhat suddenly, almost simultaneously. Here no opposition existed, houses were gladly thrown open to disinfection, and although six hundred unacclimated persons resided in the infected areas, the cessation of the fever was total and immediate.

In contrast with New Orleans experience of 1875, Pascagoula recognized the first yellow fever death on the fourth of August, only eight days before the first death in New Orleans. The total number of cases in the main epidemic centre of New Orleans was less than fifty, only four of which occurred in November, whilst several hundred cases occurred at Pascagoula; the disease spread to Moss Point and Fowl River, and prevailed until the close of December, the last known death, by yellow fever, at Moss Point, vicinity of Pascagoula, happening January 3, 1876.

During the present year, 1876, the first case of fever, probably indigenous, appeared August 11. Disinfection was promptly and thoroughly made; no subsequent cases in that locality. Second case of the year in another neighborhood. Thorough and prompt disinfection of the premises, none beyond them. September 20, no further sickness. Up to September 23, not less than twenty cases have occurred; but since this first case, the principles and methods herein announced have been abandoned by the present sanitary authorities, and disinfection of the antique and oft-proved futile type practiced, — merely that of the room, clothing, and bedding of the patient, and, at most, limited to the original premises. A proceeding as wise as if the efforts to control a fire in a densely built neighborhood should be limited to extinguishing the already nearly consumed building, and applying no water whatever to its heated and already smoking neighbors. If an

immediate change of sanitary policy is not inaugurated, a serious prevalence of yellow fever is predicted.

By action taken at the last session of the Legislature, due to the united influence of the Chamber of Commerce of New Orleans and the Board of Health, detention at the quarantine station has this year, for the first time, been reduced to merely that required for proper disinfection. As has been before stated, the practice of re-disinfection, after arrival in the city, has been carried out since the beginning of summer, and on board the many vessels which have arrived from tropical ports at the wharves of New Orleans up to September 23, not a case of yellow fever has appeared.

The evidence, positive and comparative, may be briefly stated: During the years 1870 to 1875, inclusive, the plan of disinfection has been persistently and systematically followed up in New Orleans, and improved as experience from year to year suggested. During the same period, while New Orleans has escaped, yellow fever has prevailed in an epidemic form, and in some localities more than once, at Mobile, Key West, Pensacola, Barrancas, Powell's Point, Fowl River, Scranton, Pascagoula, Moss Point, Jackson, Canton, Natchez, Shreveport, Memphis, Montgomery, various places on Red River, and at not less than fifteen points in Texas, spreading from Shreveport, where disinfection was not adopted. The facts, as at present understood, give a result in favor of the control of yellow fever by the coal-tar acids.

The experiment has latterly been conducted in as strict accordance with scientific methods as is practicable with the means and intelligence engaged. To facilitate investigation, maps were prepared exhibiting, at a glance, the locality and date of appearance of all cases of this disease, and date of disinfection of all premises. The real or apparent relation of cases to previous or subsequent cases, and the actual or seeming efficacy of disinfection, were carefully considered and the results recorded. Great as are the difficulties which surround the experiment, if the process be continued sufficiently long, and in a scientific method, a result conformable to truth will be reached. In a series of observations, conducted on correct principles, honestly made and recorded, the tendency is to eliminate errors, bring truths into prominence, and develop law.

In further continuing this experiment, those who have hitherto conducted it, claim that no adverse decision be rendered till the precise theory and mode of disinfection herein announced have been tried methodically, minutely, patiently, and repeatedly. Results may be but seemingly good or bad. Failures as well as successes may be only coincidences.

SCARLATINA IN BALTIMORE AND BELAIR, MD.

By JOHN MORRIS, M. D.,
Baltimore.

A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 6, 1876.

A few years since, Dr. Alfred Carpenter, of Croydon, published some original and suggestive views in regard to the causation of scarlet fever, which greatly attracted my attention, and I determined to seize the first opportunity to verify their accuracy. Dr. Carpenter holds that inasmuch as scarlatina has been found less amenable to prophylactic measures than some other enthetic diseases, and that, as it does not depart from those places in which the usual sanitary operations have been carried out, such as the supply of pure water, the abolition of cesspools and the construction of properly designed sewers, it must, therefore, possess an element different and distinct from typhus and typhoid fevers. It is his opinion that it can originate from the decomposition of the blood of vertebrate animals, and that in those districts where much blood passes into the sewers and then becomes putrid, scarlet fever is almost sure to arise. A recent outbreak of this disease in Baltimore has, in my judgment, afforded some confirmatory proof of the correctness of this theory. This outbreak appeared to originate in, and at first in a great measure to be confined to, a portion of the city in which there are a large number of slaughter-houses. I determined to make a thorough examination of this locality, with a view to discover if such a condition of things existed as Dr. Carpenter argues will produce scarlatina, *de novo*. Investigation discovered a small stream, a few feet wide, running for more than half a mile from the hill on which the slaughter-houses before mentioned are situated, down into a tract of low, unoccupied ground. The water of this run is stagnant, and any organic matter that may be in it can only be removed by heavy rains. On a first visit, a bottle of this water was taken for examination, but in less than twenty-four hours it became filled with maggots, and a second supply was procured and placed in the hands of Mr. Bellerman, a chemist, who furnishes the following statement: —

Examination of Water. — The water was turbid and of a reddish color, putrid odor, and alkaline reaction.

To 0.5 liter was added 0.5 grams of pure sulphuric acid, the mixture heated to about 70° C. and then triturated with a solution containing one gram permanganate of potash to one liter of distilled water, of which it decomposed 522 c. c. During the operation there was a decided odor of the volatile acids resulting from the decomposition of fats.

According to Professor Weil, of Giessen, good drinking water should require not more than one to six cubic centimeters of this solution to the liter.

My friend and former pupil, Dr. Seldner, of Baltimore, subjected a portion of this same water to the action of the microscope, and found it filled with fat cells and germs of organic matter given off from the decomposition of blood, and corresponding exactly to the description given by Dr. Carpenter. In the neighborhood of this run, or putrid stream, the mortality was very great, the disease assuming a most malignant form. Dr. Russell, a respectable physician, states that the first five cases to which he was called on Chapel Street, in this vicinity, proved fatal. In another portion of the city, lower down, but in the same section, called Canton, a very large number of cases have occurred during the past year. A dirty, stagnant stream or run, called "Harris's Creek," flows along this part of the town, and empties into the river at the lower side. Into this creek, through a number of imperfect drains, across a marsh or low piece of ground, run the blood and refuse matter of a number of slaughter-houses. At several points, the air reeks with the foul effluvia.

A slight epidemic of scarlatina also prevailed about the same time in Belair, Md. Belair is a small town containing from eight hundred to a thousand inhabitants, and had been, heretofore, unusually free from diseases of a zymotic character. About twenty-seven cases of scarlatina occurred in all, the origin of which could not be traced out by the medical men of the place, though they believed it was due to importation. On looking carefully for local causes, none could be discovered of sufficient magnitude to account for the invasion of the disease. A small stream runs across the town near its upper portion, and though stagnant at the time of examination, and bordered by decaying vegetable matter, did not appear a possible cause of the epidemic. The only slaughter-house in the town is about one hundred yards from this stream, but no communication could be traced between them. How the blood is disposed of was not apparent. Though there were cases of scarlet fever in the vicinity of this slaughter-house, the first cases did not occur there, and, therefore, the conclusion cannot be drawn that it was the exciting cause of the local trouble.

The origin of the epidemic in Baltimore can, however, be more clearly ascertained. More than 2,000 cases occurred east of Jones' Falls, if general deductions may be drawn from the statements of the leading physicians practicing in this locality, including Drs. Arnold, Lynch, Evans, Cathill, Rusk, McShane, Wilkins, Reynolds, etc., etc. The first cases may be traced to the neighborhood, influenced by the putrescent streams already described. The mortality was greater in this neighborhood, and, though the whole city was, in the end, invaded by the poison, the greatest mortality took place at these points. This preponderance of cases and this mortality must certainly be due to local causes. An eruption of yellow fever, called by the authorities, from motives of prudence, *typho-malaria*, prevails in this same part of the city, but from causes entirely different. The decomposing elements that produce yellow fever will not generate scarlet fever, though

there is a very strong connection between them. Heat, moisture, and filth — particularly if the last be due to vegetable decomposition — are necessary to the propagation of yellow fever, though the spark that lights up the poisonous pabulum is generally, as was the case in Baltimore, pelagian in character. Scarlet fever requires another factor — decomposing animal matter — for its generation, and it is this element, in my judgment, that gives it its peculiar characteristics. This element or factor did not obtain, at least so far as decomposing blood is concerned, in the yellow-fever endemic in Baltimore; that is, there were no slaughter-houses in the vicinity in which it could have originated.

From the foregoing facts, and from past experience, I am convinced that there is a great deal of force in the opinions of Doctors Carpenter and Budd, in regard to the etiology of scarlet fever. I believe with Doctor Carpenter, that there is a morbific element that enters into the scarlatina poison, not to be found in the poison of typhus and typhoid fevers, and not subject to known sanitary law; and further, that this poison is of an animal, not a vegetable nature. It may not result from the decomposition of the blood of vertebrate animals, but may have its origin in the decomposition of other animal matter. As to the propagation of scarlet fever by the infection of sewers in which animal matter is confined, I have not the slightest doubt. That an accumulation of alvine and venal discharges in sewers will produce the same effect, as suggested by Dr. Budd, is also very possible. If Dr. Budd's theory is correct, it affords an explanation of the prevalence of scarlatina among the better classes. The water-closets in the houses of the wealthy are frequently defective, and the excrementæ are therefore retained in the pipes to poison the surrounding atmosphere. Medical men in attendance in dwellings of the rich are too often made painfully sensible of this condition of things. The prevalence of scarlatina in camps and military stations remote from centres of contagion can be explained in a like manner. This view of Dr. Budd, taken in connection with the theory of Dr. Carpenter, is worthy of serious consideration, and it is my purpose to pursue the investigation further whenever opportunity is afforded.

In the future, however, it seems to me that a large share of the work of sanitarians should be devoted to the seeking out of the causation of this disease. The knowledge that typhus fever can originate from over-crowding, and typhoid from the effluvia of excremental matter, gives to sanitary authorities power not only of prevention, but control over both these diseases. Let as much be known in regard to the origin of the even greater scourge of our civilization, scarlatina, and we may then indulge the hope of its arrest, if not final extermination.

VI.

SPECIAL SANITARY TOPICS.

ANCIENT AND MODERN HYGIENE CONTRASTED. — THE INFLUENCE OF CIVILIZATION ON THE DURATION OF LIFE.

By CHARLTON T. LEWIS, Esq.,

Secretary of Chamber of Life Insurance, New York.

A DISCOURSE AT THE ANNUAL MEETING, BOSTON, OCTOBER, 1876.

That the State is the final cause of the individual, was the political theory and the moral law of the highest ancient civilization. The citizen's rights and duties were measured and limited by the interests of his city; his glory lay in what, by living or dying, he could add to its glory. That the individual is the final cause of society was the early Christian theory, which disintegrated the Roman Empire, which set up above the work of love and of statesmanship the saving of each man's soul, and which, slowly purified from king-craft and priest-craft, survives in the democratic politics, and in most of the economical and social science of our own day. The conflict of these two theories, in its many phases, has been the best part of history; for it has been the conflict of ideas, and of minds loving the truth, while the rest has been the struggle of grasping selfishness, or of passion. Yet this conflict has been but the prophetic shadow of one more momentous, which begins in our own day, and in which is destined to move and work, for hope or for despair, the intellectual life of generations to come. The relation of individual man to organized society is but one of the outward forms assumed by his profounder relation to the human race; and it is with this relation, as determining the meaning of his nature — physical, mental, and moral — that modern thought must deal. Is the end of our being to be sought in the individual or in the race? This may be presented as the final problem, alike of science, of philosophy, and of religion. Immanuel Kant had, perhaps, the sharpest mind's eye that ever tried to scrutinize mind. But long before he began his immortal researches into the basis of certainty, his studies had taken a still wider range. In early life he wrote some fugitive papers for an obscure journal, which I have not now within reach, and of which I can speak but vaguely from recollections of a perusal many years ago. But one thing is certain, that in them he foreshadowed the great problem which was to occupy coming ages: he saw and declared that the persistent race and the transient individual are the poles of thought,

and that around these the mind of the world must yet move. Doubtless Emerson had read these papers, when, in one of his early essays, he pointed out the mystery of nature, "the race never dying, the individual never spared." And Tennyson had certainly read them, when he translated their thought with startling fidelity, in one of the most suggestive passages of the "In Memoriam," —

> "The wish that, of the living whole,
> No life may fail beyond the grave,
> Derives it not from what we have
> The likest God within the soul?
>
> "Are God and nature then at strife,
> That nature sends such evil dreams?
> So careful of the type she seems,
> So careless of the single life,
>
> "That I, considering everywhere
> Her secret meaning in her deeds,
> And finding that of fifty seeds
> She often brings but one to bear,
>
> "I falter where I firmly trod."

These were but the prophetic utterances of seers, dimly apprehending from afar the revolutionary thought of the next age. I must not weary you at the threshold of my subject, or it would be in place to point out how the history of ideas for a century past has revolved around the same centre, approaching it more and more closely. Kant himself, in after life, became the source of a magnificent series of movements, including many of the noblest efforts ever made to reach absolute truth, and culminating in the Hegelian philosophy; the practical meaning of the whole of which was resistance to the inevitable tendencies of the time; efforts to centre the universe in the individual man, though only by raising him to a higher level and presenting him as pure intellect. It was impossible; and the philosophy of the great German school is as far behind us now as that of Aristotle or Spinoza. On the other hand, the greatest of French thinkers, Comte, catching the spirit of the age, attempted to build up his universe of thought on the new conception — the absolute subordination of the individual to the race; and failed to become the acknowledged teacher of our times only, perhaps, because he built by old methods and with old materials on the new basis; because the times were not yet ripe, and the key to the relations of the race with its members was not in his hand. Had he but grasped the two master-thoughts of our own day, — the conservation of force in physics, and the origin of species by natural processes in biology, — he would doubtless have developed the continuity of nature in a system almost fitted to fulfill his dream of organizing and lastingly enslaving the human mind.

I have called your attention to this problem, not because I propose to discuss it, or even to state it fully, but because my special subject this evening leads up to it, and derives interest and value from it. To what extent man is merely a species, a product and a part of the system of nature, and

to what extent, if any, he is an exception to it, or above it, are questions which are closely linked with all intelligent study of ourselves and our surroundings; and it is in the light of these questions that I have sought to explore one little subordinate corner of the boundless field — the changes, if any, which civilization brings about in the average duration of human life, and the causes which produce them. The subject is fascinating, because it has never, as far as I can learn, been thoroughly examined; because it furnishes the most simple and definite measure which can be applied to so vague a conception as progress; and because it seems, at first sight, as if there must be a vast amount of trustworthy evidence accessible upon the average age attained by mankind in all periods of history. After spending a very considerable amount of time, however, in the effort to find and collect this evidence, I am compelled to acknowledge that the results are vague and meagre, and that some centuries of statistical records, such as have never been kept in any country until within the last two generations, will be necessary, before the effects of culture upon longevity can receive an accurate and scientific statement.

It is beyond question that civilized man lives longer than the savage. Our days, on the average, are many more than those of our ancestors of the stone age or the lake period. Some degree of civilization is therefore favorable to longevity. But when we ask whether the extension of life continues as enlightenment grows, the question becomes complicated. A generation ago it was asserted with confidence that the specific duration of human life has for some ages been increasing perceptibly, and so rapidly that tables of mortality made from the experience of one generation are inapplicable to the next. This doctrine will be found throughout much of the most worthless literature in the world — the books on longevity — stated as if it were an obvious law of nature; but the only pretense of proof is that the famous Northampton table of mortality, and others constructed by similar methods, have been found to show a much shorter expectation of life than the experience of our own day. The science of statistics, however, has long left such notions behind, and has shown that the inaccuracy lies in the methods of constructing earlier tables. They do not properly represent the law of mortality at the period and in the community for which they were made; and it is only in very recent times that statistics have been collected with care enough, and on a basis wide enough, to establish that law. Nor are they now so collected, except in a few European cities, as to be of value for this purpose. The American people ought to understand that the cumbrous mortality statistics published by the United States Census Bureau are a laughing-stock for scientific investigators; and that even the great improvements introduced by its recent administration, have but served to expose the imperfection of the system. The mortality tables it has constructed are not so much inductions as conjecture; and the only trustworthy evidence in existence, showing the actual influence of our own climate, institutions, and society in modifying human vitality, is that which has been gathered by business corporations — the Life Insurance Companies.

The sanguine doctrine of the rapid increase of life being exploded, it has become the fashion with a skeptical school of statistical writers to argue

that no improvement has taken place ; that the inadequate information we have, points the other way ; and that the luxury, ease, freedom from exertion, vices, and, above all, the hereditary accumulation of physical ills in civilized man, are probably shortening the tenure of life, perhaps even threatening the ultimate extinction of the more cultivated races. Many of you remember an unsavory discussion which agitated the intellect of Boston two or three years ago — echoes of which are still sometimes heard from the lecture-desk or the press — on the rapid tendency of Massachusetts to relapse into barbarism, from the decline in numbers of the native-born and intelligent people before the multiplying vitality of the ignorant classes. This kind of reasoning sometimes leads to amusing results. Thus Mr. Ray Lankester has published a work on "Comparative Longevity," in which he makes this startling remark : "Were the evolution not always in advance of the provoking cause, we might anticipate the extinction of humanity, by the excessive competition and the excessive difficulties of existence which must always accompany increased population." Dr. Hough, of Philadelphia, in one of the most elaborate discussions yet presented to this Association, insists that there is a progressive decline in the vitality and longevity of the American people. "If," he says, "all the inhabitants of the globe were living in cities of the magnitude of London, and subjected to the same influences connected with the movement of population, the whole human race would become extinct in a century or two." It is hard to believe that the human race will ever die out, as long as the earth is crowded with men ; or even as long as cities of the size of London remain. Nor, because enthusiasts have believed in an exaggerated and absurd extension of human life, and have supported the belief by mistaken facts, need we infer that the life of man is really growing shorter.

Not troubling you with the detailed facts, which seem to me to prove the contrary, I shall simply cite the highest authorities on the subject. Professor Owen, the great anatomist, has examined the subject as respects Great Britain, and is satisfied that the average life there is higher now than in the last century. Sir Thomas D. Hardy has searched the records of the English courts for four hundred years, from the thirteenth century to the sixteenth ; and among their innumerable notices of age, finds no instance of a man who had survived his eightieth year, and proofs enough that the age of seventy was rarely reached, and was regarded as extreme. Mr. Finlaison, the statistician, has studied the results of the Tontine Associations in England, from the seventeenth century down, and has shown that the expectation of life among the classes who invest in such funds has gradually increased full twenty-five per cent. during that period. Kolb, the careful and sagacious German writer on comparative statistics, sums up the case thus: "The meagre facts known indicate that the maximum age of man has remained nearly the same for centuries and even thousands of years ; but that the number of persons who reach extreme age, and especially the number who survive infancy, has very materially increased." I have examined, I think, substantially all the evidence in existence upon the subject, and find these moderate judgments to be sustained by it.

Now this improvement is just what we should expect. It depends on no mysterious law of development, no innate tendency to an increase of vitality. It is the necessary result of agencies so obvious and so powerful in our civilization, that we need statistics not so much to prove their existence as to measure their effects. Let me enumerate them: —

1st. The first is the improved care taken of infants. In savage life the babe is scarcely protected except by the mother's instinct. If this is interrupted by accident or disease, it perishes at once. It is liable at all times to fatal exposure. Step by step, improvement is made as men become civilized. In Soranus, a famous medical writer of the second century, we find an elaborate discussion of the care of infants. The Thracians and Macedonians, he says, always bound the new-born child firmly, hand and foot, to a hard, flat board. The Thessalians hollowed out the board to the shape of the body, and put in a stuffing of hay. These nations, like some North American Indians of our time, thought it necessary to hold the child motionless during its early life. Soranus himself advises that it be wrapped closely and firmly in woolen bandages, and that careful manipulations be practiced, to give shape to its head and spine. The Germans and Scythians, he tells us, and many of the Greeks, used to dip the new-born in cold water, to test its vital strength, and try whether it was fit to be reared. Soranus, who represents the highest skill of his period, warns parents against giving the babe its natural food, the mother's first milk. This must be thrown away, and goat's milk and honey substituted. Thus we might trace step by step the slow progress of medical science, and the slower progress of custom, towards the very moderate degree of excellence in both which now prevails; and remember that every step in each of them represents a gain of countless lives.

Let one proved fact illustrate the gain already secured. In London, 175 years ago, when the population was less than 675,000, the annual deaths of children under five years were 9,500. In 1810, when the population had increased to 1,050,000, this class of deaths had been reduced to 5,500 yearly — a saving of 62 per cent. on the average. Similar facts might be multiplied from statistical records, wherever health has been intelligently studied and sought. Of all the achievements of sanitary science, the greatest has been the rescue of these innocents from wholesale slaughter; yet this is still the most awful and the most hopeful field for its work. In every land, human motherhood is still a Rachel weeping for her children; the children are dying from causes which might be prevented. There is room here for boundless preaching, but where lies the responsibility? In Shakespeare's words, —

> "*Who lets* so fair a house fall to decay,
> Which husbandry in honor might uphold
> Against the stormy gusts of winter's day,
> And barren rage of death's eternal cold?"

We find, then, that an infant's chance of surviving to maturity is steadily increased as civilization advances.

2d. Substantial improvement has been made from age to age in the care

of the sick, infirm, and aged. Among savages, every serious illness ends in death. The mutual help and care by which lives which cannot support themselves are supported by others is the product of society, and grows effective as social ties are strengthened. Even in this century, and among people which have something like a social organization, the custom of putting to death those who survive their strength has been found in full force. Every stage of progress, from this barbarism to the humanitarianism of our hospital and almshouse system, may be traced, and the obvious result is a gradual lengthening of the average life.

3d. Another important agency is the avoidance of epidemics. It is hard for us to understand the horrors of these visitations in former ages. There are no more thrilling pages in literature than those which depict them. The plague of Athens, as described by Thucydides and Lucretius; those of Italy, truthfully reported in the romances of Boccaccio and Manzoni; Defoe's story of the plague in London; the accounts given by German and French chroniclers of the Black Death of the fourteenth century, — all these are fresh, with their fullness of immortal agony, in every reader's mind. And thousands of such pests have swept across nations, and left no such records. In our times, vast tracts of Africa have been depopulated by fever; whole tribes of Indians have been destroyed by small-pox. We are exempt from such disasters. It seems that civilization has outgrown the danger of them. The test has been applied. The cholera was made dreadful to the thought by its ravages in the East, and by association with the plagues of history, when it began its march across the civilized world. But it touched enlightened nations too lightly to revive such memories. Of the 40,000,000 of people whom it slew in the half century after the wars of Napoleon, but the smallest fraction fell in Christendom. A century ago the small-pox was the scourge of mankind. Its deaths numbered 400,000 a year in England. La Condamine, the first authority in his day, who died in 1774, asserts that it carried off one tenth of mankind, and disfigured as many more. It is practically abolished by a single discovery, which has added two years to the average life of man in Central Europe. The victories of civilization over some other diseases have been scarcely less signal. For example, scurvy in our navy has been exterminated. Death from it is now literally unknown. I have not been able to find the statistics of its earlier ravages there; but in the British navy, for two hundred years back, the mortality by scurvy exceeded that by battle, wreck, and all the calamities of sea-life together. Sanitary science has done away with it. In the thirteenth century, leprosy was at least as common as measles now are. Matthew Paris perhaps exaggerates the number of lepers, when he tells us of 2,000,000 in France, and of 19,000,000 in Europe; but the disease was a general plague, and has disappeared before civilization. In the same way typhus, dysentery, yellow fever, scarlet fever, in different degrees, are beginning to yield up their fatal energies, and we are learning to hope and strive for their extermination.

Other great calamities have been overcome or reduced in their proportions by the progress of society. Thus famines figure in the history of all uncivilized countries as causes of immense mortality. A large proportion

of the whole people of Germany starved to death during the latter part of the Thirty Years' War. Mr. Froude finds that at least 200,000 lives were directly destroyed by the Irish famine of 1846. These are the frightful exceptions of an imperfect civilization; but in Germany, Ireland, or this country, now, one death by famine is enough to agitate the community and is nearly impossible; while in some barbarous countries, more lives are ended by want of food than by disease or accident. Civilization, by its arrangements for storing and distributing food, and by the greater certainty it gives to agriculture, prevents alike general famine and individual starvation, and thus lengthens the average life.

4th. Finally, I must dismiss, with a mere reference, a large class of causes which are working in the same direction: our advancing knowledge of the laws of health, and numberless applications of them, public and private; in police regulations, building laws, quarantines, and public works; in the construction of dwellings, the heating and ventilation of rooms, the preparation of food and clothing, the hours of labor and rest. In all these there has been a slow practical improvement for ages; and there now begins to be a scientific improvement which promises to be much more rapid.

In order that these remarks may not fill a volume, I must omit to discuss here the application of the doctrine of heredity to these forces, by which the impression they make upon the physical frame of Man, in any generation, increasing its vigor, vitality, and possible duration, is transmitted to posterity, and thus accumulated from age to age. It is this law which co-ordinates all the influences we have enumerated, and combines them into one movement, continuous and progressive. We may fairly affirm, then, that the average duration of human life is the most definite measure we can apply to the advance of civilization. The lowest races of mankind, in Sumatra, Borneo, Australia, New Zealand, Central Africa, Patagonia, are alike in this, that their life is short. Female beauty is in its prime at fifteen; it decays after twenty-two. Man is old at forty; he rarely reaches fifty, or only in extreme decrepitude. If we turn from this state of life, in which our ancestors doubtless once stood, to the nations of Christendom, and classify them in the order of the average duration of life, we shall have arranged them also in the order of wealth, good government, and intelligence. Average longevity is at once the most potent agency in producing these elements of prosperity, and the result which the forces of civilization unite to effect, and on which their energies are concentrated. In an economical point of view, this relation is obvious; for the lengthening of life implies, above all, the lengthening of the productive period, — the increased proportion of producers to drones, and a diminished waste in unproductive lives. Herbert Spencer, after a careful survey of the biological aspects of human development, in one of the most suggestive books of our age, finds the fundamental fact in the restless antagonism between the development of the individual and the perpetuation of the race; and that this conflict "insures the final attainment of the highest form of this maintenance, — a form in which the amount of life shall be the greatest possible, and deaths the fewest possible." In other words, the lengthening of the average individual life measures human progress.

Now an eminent school of scientific men are teaching the doctrine of natural selection, or the survival of the fittest, as the key to all progress in nature. I wish distinctly to bring out the startling contrast between this law and the laws of progress in vitality which we have found actually at work in human history. The first condition of natural selection is wholesale slaughter. It begins by assuming the principle of Malthus, that life tends to multiply beyond the possibility of preservation; of the infinite mass that come into being, nearly all must perish unfulfilled. Who shall the survivors be? Those, of course, who, by superior vigor or by greater harmony with their environment, are most fit to survive. These alone live to reproduce their kind, and transmit the superiority which has preserved them; and thus, in successive generations, the race accumulates the qualities which promote life. Thus the natural process of advancement is founded on limitless waste; the growth of life is in the soil of boundless death; the better form springs ever from a world of graves. Mr. Huxley tells us that the law of evolution, founded on this conception of natural selection, as explaining the mode in which the organic world around us has arisen, stands on a basis of evidence comparable to that which supports the Newtonian theory of the solar system. Let us admit it, then, to the full extent claimed. Admit that man himself, in the structural differences between him and lower forms, is the product of this law, and that, up to the time when he became distinctly human, as contrasted with his quadrumanous kindred, his development was governed by it. We shall see that his human progress is of an entirely different character. Observe that the forces which we find at work in the physical and mental growth of man are not merely independent of natural selection; they are exclusive of it, and at war with it.

Look at each of the agencies we have enumerated. Of a generation of infants entering the world, natural selection says, Let them meet hardship, severity, disease, which will destroy all but the most vigorous, and leave these to become the parents of a hardier race. To the infirm of all ages, the diseased, the old, it says, Perish out of my way. You are worthless of yourselves; and, if allowed to multiply, you but perpetuate helplessness and increase misery. Of epidemics it says Let them rage; they may sweep away strong and weak together, but not without discrimination. They destroy a larger share of the feeble, and leave the average strength of the race and its posterity greater than before. By the standard of natural selection, it would be clear gain that the human race should be exterminated to-day, saving only a handful of the most perfect humanity, to re-people the world after a higher standard.

But the foundation of society introduces the opposite principle. Family affections and social ties have their meaning in the value of the individual life to others; its value to society at large is the central thought of civilization. The preservation of each by the common work and mutual aid of all is the aim of government and law; the basis of families, communities, and nations. Thus the formation of society is the reversal of the blind law of unconscious advancement, and its every step forward weakens the forces on which this natural development depends. Its history is a struggle against

the conditions of natural selection, and a steady reduction of its area of influence. Society preserves, for the progenitors of the future, alike the weak and the strong, the diseased and the healthy. If, then, this blind law is the one key to progress, man must degenerate. Pessimists, then, are right in holding that all our charities, public institutions, sanitary improvements, the very order of society itself, are but means of protecting the weak against the sentence of nature, and of perpetuating their weakness. Benevolence is then but folly, mercy a crime, the charities of civilized life a pernicious force, working for the degeneracy of the race.

There is but one reply: Civilization does largely sacrifice one principle of progress — the law of evolution by survivorship; but it introduces another more potent principle. Under natural selection, improvement must needs be fitful, occasional, and immeasurably slow; because the variations upon which it works and among which it chooses, are but casual deviations from an average standard, which it can at most catch and preserve. But civilization possesses the element of individual culture, by which the standard itself is raised from generation to generation. Society educates the child into a higher type of power, endurance, and refinement than that in which he was born; its effects are stored up in muscle, nerve, and brain, and through him transmitted to posterity, and thus accumulate from age to age. Under natural selection, when variations in capacity arise, thousands of them are wasted where one is secured, fixed, and transmitted. But human society economizes much of this waste, fastens upon and improves an immensely larger proportion of the capacities lavishly produced by nature, and thus concentrates, in the brief historical movement, forces which would otherwise spread their operation over countless ages. Thus it is the characteristic of civilization that the hereditary accumulation of intellectual and moral culture gradually supersedes the unconscious and physical law of selection as the agency of progress.

Now history, while it has been a struggle between these two principles of advancement, has also been a test of their comparative power. Natural selection, as its ablest expounders have shown, works with such extreme slowness, under the most favorable circumstances, that the progress of its work has never yet been detected by observation. No instance is known of its having effected any marked and important change in any race of creatures, during the period of history. Vast as is its cumulative force, it is exerted only in the course of ages defying our imagination to span; and to accomplish a small part of its work, it must cleave its path of misery and slaughter through epochs measured only by the formations of geology and the cycles of the stars. But the intellectual and moral forces of culture, which have superseded it in man, have actually, within the brief space of a few thousand years, achieved the world of happiness in which we live. The rocks register the story of a blind evolution, which they tell us is still going on as rapidly as ever, yet so slowly that the eye which watches for a few centuries or millenniums can discern no movement; they cannot explain those laws, by which, within generations too few to make one of their minor epochs, the beast-like companions of the cave bear and the mammoth — the

wandering barbarians of the flint period — have produced the intellects of Shakespeare and Newton, the scientific culture and the free society into which their descendants are now born.

We have seen that where animal evolution ends and human progress begins, the laws of individual and hereditary culture supersede the law of natural selection. An interesting consequence of this is the fact that it makes a place for the prolongation of the individual life beyond the period of vital and muscular activity. Under the reign of natural selection, there is no position in the universe for the being who has passed the reproductive stage of energy. Hence wild animals, soon after this period, usually die; and, similarly, savage society has no home for old age. But civilization centres wholly in the intellect, whose forces are communicated by other than vital processes — in ideas which move and mould the world through the minds and the posterity of others; and the intellect, under favorable circumstances, not only continues its work, but grows in efficiency and usefulness long after time has impaired the physical powers. It is in civilized society alone that the activity of the brain makes old age valuable; and as civilization advances, the economy of preserving a strong and cultivated mind through the longest possible period of activity becomes more and more practicable, and yields a richer reward. Thus it is a strictly scientific truth, that the best symbol of progress, the pride of social achievement, the noblest ornament of our race, is the venerable man, who, in a decaying body, preserves the energies of a wise, benevolent, and vigorous mind.

If so much has been done by the semi-conscious work of society, in using and developing the natural forces of man, how much might be done by a perfect organization of society for that work! This brings us to that stupendous conception to which, more in jest hitherto than in earnest, the term stirpiculture has been applied. But we can imagine a future sect of positive philosophers, who shall reason as follows: Man has been produced through vast epochs by natural selection; he has been immensely improved in one era by the half-conscious, imperfect form of selection which has superseded it; and it is certain, therefore, that nature has placed in him, in the processes of growth, waste, and decay, an infinite elasticity. Were society organized to improve this elasticity to the utmost, he might rapidly scale heights of being which are unimagined now. Take up the average duration of life, for instance, and make its increase the intelligent aim of society. Subordinate to this aim all the relations and affections of men; let marriages be planned, posterity sifted, medical and social science directed, for the one end of lengthening life; and in generations as few as are required by the horticulturist to produce the gorgeous multiple flower from the timid wood blossom, or by the breeder to bring the wind-fleet racer from the ordinary horse, we might become a people of patriarchal longevity. Nay, let society choose its own ends, set before itself the highest conception of a model humanity, and sacrifice all individual and personal aims to its attainment, by a vigorous selection and preservation of every tendency toward it, and then will begin the evolution of the golden age. We can imagine, I say, such a sect of philosophers; and violently as such a society shocks our

habits of thought, there is a tendency in contemporary mind to something like this system. This is, indeed, the logical extreme toward which our science is pointing; never to be realized in all its naked absurdity, of the absolute loss of the individual in the idea of the race; but destined, as a tendency, followed with greater or less intelligence of its real character, to jar harshly and shock fiercely in the future against the cherished rights, affections, and aspirations of the mind, which cannot despise its own personal consciousness, nor unlearn its own hope of immortality.

Thus our special subject leaves us at the threshold of a world of restless thought. And at the close of our study, as at its beginning, the Sphynx of life still stands before us, with her problem unsolved: Is it in the destiny of the race, or in that of the individual man, that we are to seek the end of our being? But if we have not found the answer, we have found reason to be content without it. The two conceptions of life seem to us wide apart, when we contrast work with culture, the creed of the Presbyterian with the creed of the Transcendentalist, the life of John Howard with the life of Goethe. But in the principles which underlie the progress of mankind, we see a tendency to reconcile the two. The capacity for individual culture is a growth from the soil of an advancing race, and the further that culture is carried, the more richness it returns to the soil. So we may be sure that the time and effort wrested from personal growth for the service of society in its thousand forms is not waste for the individual; that the time and effort withheld from social work for personal culture is not lost to mankind; and that every step toward the more perfect organization of society leads to a wiser and more fruitful distribution of its forces between the two ends, making them one. The problem will remain unsolved; the conflict will continue; the man will often groan in discontent that "large results of force" which might have been self-enfolded, must be scattered and spent, though in the service of mankind; crying, —

> "I doubt not through the ages one increasing purpose runs,
> And the thoughts of men are widened with the process of the suns.
> What is that to him that reaps not harvest of his youthful joys,
> Though the deep heart of existence beat forever like a boy's?"

But he will more and more rise above himself, merge his own aspirations in those of humanity, and triumphantly add: —

> "Not in vain the distance beacons. Forward, forward let us range,
> Let the great world spin forever down the ringing grooves of change.
> Through the shadow of the globe we sweep into the younger day;
> Better fifty years of Europe than a cycle of Cathay."

PUBLIC HEALTH INTERESTS CONCERNED IN THE PRESERVATION OF CERTAIN PRIMEVAL FORESTS AND IN THE CULTIVATION OF GROVES AND TREES.

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The influence of woodland shade upon the public health, presents a theme for thoughtful inquiry, and the more so, because it is almost wholly under our control, and as found beneficial, inconvenient, or injurious, it may be increased, diminished, or suppressed. We will dismiss from the present inquiry all ideas of pecuniary profit or economy, involved in the cultivation of timber as a material, or otherwise than in its presumed relations to sanitary science; and will endeavor to point out the manner in which the cultivation of trees may, within proper limits, be made a measure of utility as regards human health, and the reasons that may be assigned for this influence. In doing this, it will be proper to consider as well the direct effects of temperature, moisture, electricity, and other physical causes, as the less tangible but not less real effects by which, through the senses, they operate upon the mind.

It will be conceded that a country wholly and densely covered with a forest, more especially if the surface be level, the drainage imperfect, and decaying organic matter present, is less healthy than one more exposed to the sun and open to the winds. In a region thus densely covered, the soil and the stagnant air near the surface, are at all seasons overcharged and often saturated with moisture, and the decaying vegetation always present, will, in hot climates and seasons, tend oftentimes to malarious diseases of a typhoid, and sometimes of a malignant type. These humid conditions, in colder regions, and in winter, predispose to pulmonary and rheumatic diseases. These effects are more apparent upon the new-comer than upon one long resident, so that the immigrant may suffer, where the acclimated would feel little or no inconvenience.

It is well known that the most virulent forms of malaria have been witnessed in countries where swampy low-lands have been newly-drained and cleared, and the decaying vegetation first exposed in hot seasons to the sun and the air, in the first attempts to cultivate the soil. Yet, in most cases, where the drainage can be made complete, these conditions will wear away, as the organic matter in the soil becomes fully decomposed; and a region once noted for insalubrity may become quite free from malarial diseases, and even exceptionally healthy. Thus the Genesee country, in Western New York, and the lake region of Northern Ohio, have, by patient waiting

and persistent industry, fairly outlived the bad name acquired in the days of pioneer settlement. Other regions, like the Maremma of Tuscany, by dint of long and costly effort, guided by science, have regained their ancient prestige for salubrity, while others, like the Campagna of Rome, remain as possible fields for re-conquest, but not without heavy expenditures of life and treasure, and others, like the tropical jungles of India and Africa, which have remained since the earliest known period the seat of deadly miasms, will probably so continue beyond the power of man to overcome, or, if too venturesome, to escape.

It may be deemed a fact established by frequent observation, that belts of woodland, intercepting the sweep of winds from the swamps, purify them from malarious emanations; but whether this be from mechanical obstruction, or from the absorption of the poisonous effluvia of the marshes, has not been sufficiently proved by scientific observation.

But aside from this influence of woodlands upon malaria, the ordinary conditions of the atmosphere dependent upon the presence or absence of forest shade, present the most interesting themes for observation. Among the most obvious of these, is a tendency to the equalization of temperature throughout the year; moderating the extremes of heat in summer and of cold in winter, as well as the changes between day and night.

We know that sudden vicissitudes of temperature, or a steady maintenance of either heat or cold, in unusual degree, and for a considerable time, operate notably as a predisposing cause of disease. A high and sustained heat, especially if it continues into the night, as in tropical climates, is debilitating in its effects. Under this influence, the muscles, and with them the heart and arteries, lose their power and tone. Respiration is reduced in frequency, the cutaneous and bilious secretions are increased, and that of the kidneys is diminished, the nervous energy is relaxed, and a general languor and debility is induced, predisposing to dysenteric and other intestinal disorders, and bringing the system to that condition most susceptible to diseases of a typhoid or adynamic type. It is at such times, especially when putrescent organic matter is allowed to diffuse its emanations near human habitations, that malignant epidemics appear and spread, until finally subdued upon the return of confirmed cold weather.

A person who has been exposed to unusual heat for a length of time, without apparent injury, may suffer sooner from the sudden alterations of temperature liable to occur at the close of the hot season; and hence autumnal fevers, and other forms of disease, appearing at the end of summer, and which are sometimes more fatal than the sickness of midsummer, may prove more malignant, because the system, weakened by long exposure to heat, is then less able to withstand these sudden transitions between heat and cold.

A low temperature, when extreme and long continued, operates as a direct sedative; abstracting the animal heat faster than is consistent with full health, and reducing all the vital powers, weakening the circulation, arresting or greatly reducing the cutaneous secretion, increasing that of the kidneys, and tending to cause internal congestions and pulmonary disease.

Excessive moisture, with extremes of either heat or cold, may be said to generally aggravate their injurious tendencies. A very dry air exerts on the body the influences due to rapid evaporation and a high degree of electrical tension, which, while they may be beneficial to some persons, will in others tend to excite cutaneous inflammation, fever, and thirst. Its effect, however, if not in extreme degree, and too long continued, is more generally beneficial than otherwise.

Any causes, therefore, that tend to moderate the extremes of heat and cold, — rendering our winters warmer, our summers cooler, and the country less exposed to sweeping winds, which often bring the noxious exhalations of marshes far beyond their otherwise normal reach, — may be ranked as salutary, and worthy of attention. These effects our woodlands and groves directly tend to accomplish, in proof of which I invite your attention to the following thoughts and facts: —

The tendency to equalization of temperature between winter and summer, and between day and night, has been observed in woodlands, in all ages and countries, and is within the personal knowledge of every common observer. We seek the shelter of the grove in summer for its refreshing coolness and shade. Of the throngs that migrate from our crowded cities on the approach of the warm season, the greater part seek a rural retreat. No place is so inviting as that which offers opportunities for rambling in woodlands, and resting in the shade of trees, and our picnic excursions of a day seek nothing else. So it has been in every age and country; and Pliny, writing more than eighteen hundred years ago, thus speaks of trees, as rendered in the language of his translator, Holland: —

"In old time, trees were the very temples of the gods; and according to the ancient manner, the plain and simple peasants of the country, savoring still of antiquitie, doe at this day consecrate to one god or another, the goodliest and fairest trees that they can meet withall. And verily wee ourselves adore not with more reverence and devotion, the stately images of the gods within our temples (made though they bee with glittering gold and beautifull yvorie) than the very groves and tufts of trees, wherein wee worship the same gods in all religious silence. First and foremost, the ancient ceremonie of dedicating this and that kind of tree to several gods as proper and peculiar unto them, was alwaies observed, and continueth yet to this day. For the mightie great Oke called Æsculus, is consecrated to *Jupiter;* the Lawrell to *Apollo;* the Olive Tree to *Minerva;* the Myrtle to *Venus;* and the Poplar to *Hercules.* Moreover, it is received and believed generally, that the Sylvanes and Faunes, yea, and certain goddesses, are appropriate and assigned to woods and forests; yea, there is attributed unto those places a certain divine power and godhead, there to inhabite; as well as unto heaven, the proper seat for other gods."

This esteem for groves, which in the olden time was fostered by religious sentiment, and which has in all ages and countries been favored by the common sense of mankind, must have some substantial causes; and here scientific observation may guide us in determining the elements. We have not yet in this country any series of thermometric and hygrometric records,

made with direct reference to the influence of forests and woodlands upon the climate, and the extent to which we may, through their agency, modify these conditions. The only series of observations that has hitherto been made upon this point, upon a scale sufficient to give absolute and trustworthy results, is that begun in 1867, under the direction of Dr. Ernst Ebermayer, Professor at the Forest Academy at Aschaffenberg, in Bavaria, and at stations for comparative observations established at his suggestion at other points in Europe. There are now about six of these in Bavaria, ten in Prussia, one in Mecklenburg-Schwerin, three in Alsace-Lorraine, one in Bohemia, three in Switzerland, and one or more in France. In a correspondence which I have had with Dr. Ebermayer, he expresses an earnest desire for coöperation in the United States, in order that the laws which govern these influences may be fully determined. Accidental circumstances may affect local observations ; and in order to arrive at general laws, the records should be made in various countries and climates, with instruments comparable as to their scale, location, and time of observation, and as nearly alike as may be in all the circumstances that may affect their indications.

Of course each station should have two places of observation, and two sets of instruments ; one in the open fields, entirely away from the local effect of the forest, and the other in the midst of its shelter, and fully within its influence.

The instruments consist of common and self-registering thermometers, psychrometers, and means for carefully measuring the rain-fall and evaporation, direction and force of winds, barometric conditions, and, at some stations, the electricity and ozone. The temperature in the woods is taken at the level of the tree-tops, and at both places at five feet above the ground ; and below the surface at depths of one half, one, two, three, and four feet. The hours of observation are at 9 A. M., and at 5 P. M. The elastic force of vapor and percentage of saturation are deduced from the wet and dry bulb thermometers, and the amount of rain and snow, and rate of evaporation by weight and measure. But one set of records is made of barometric pressure, and aspect of sky. Care is of course taken to keep out from the immediate influence of particular trees, and to see that the instruments shall give a fair average result of the conditions in which they are placed.

These observations, so far as published, tend to show the following facts : —

1. That the average annual temperature of the atmosphere in the woods is one and a half to two degrees Fahrenheit below that of the open fields.

2. That the average annual temperature at the crowns of the trees is about one and an eighth degrees above that found in dense woods at five feet from the ground ; and that in the former case the average is a little over half a degree ($\frac{27}{40}$) below that of unwooded land, at a point five feet above the ground.

3. That in spring the average temperature in the forest is about 3° below that of unwooded land, the difference being relatively less among deciduous trees than among pines.

4. That the average temperature in the daytime, in summer, in thick woods, is 3.78° below that of unwooded land.

5. That the temperature of the atmosphere within the woods, in the summer season, increased 3.94° from the ground to the tops of the trees.

6. That in autumn, the difference of temperature at five feet from the ground, is scarcely $1\frac{1}{8}°$, and,

7. That in winter the difference almost entirely disappears.

As a direct result of this difference, there is observed a current of air in the daytime, from the surface of the ground in the woods, upward and outward, the cooler air spreading over the open fields. At night, the conditions are changed, and we have currents from the fields to the woods, and thus alternately, like the land and sea breeze. In some cases the woods were found over 8° cooler by day, and $4\frac{1}{2}°$ warmer by night, than the open field.

The differences of temperature may be ascribed, —

1. To the obstruction of the sun's rays by the foliage, or the direct effect of shade.

2. To the cooling due to evaporation that is constantly going on from the leaves in the growing season, whereby much heat becomes latent, and,

3. To the fact that wood is a slow conductor of heat, so that the body of a tree, exposed to the sun, or surrounded by warmer air, slowly absorbs heat and does not reach its maximum till late in the afternoon, nor does it cool down to the temperature of the chilly night-air till near morning. It thus absorbs heat by day, and gives it out by night.

It does not need an instrument to prove that the snows lie on the surface much longer in the shade of forests than in open fields; nor that the shaded soil, especially when covered with a matting of decaying leaves, retains moisture, and maintains the supply of water for springs and rivulets, while the open field is parched with drouth, and summer brooks diminish and disappear under the drying effects of the sun and winds. Nor is it a theoretical statement, that the retention of snows in climates where they fall, has a tendency to delay the premature blossoming of fruit trees, by tempering the heat of the early spring, until danger from late spring frosts has passed, and thus a fruitful season is secured in localities where, without this equalizing influence, it would be often lost; nor can it be doubted but that the moderation of extremes in temperature, which forest shelter secures and maintains, results in great benefit to the farmer, as well in his fruit and his grain fields as to his farm stock.

The Bavarian records show that there is less than sixty-four per cent. of evaporation from a given surface of water in the woods than in the fields, and this difference is about the same at all seasons. Probably the stagnant condition of the air is partly the cause of this, as in dense woods the winds but slightly disturb the surface. A large amount of evaporation is, however, going on through the growing season from the leaves, so that the relative humidity is greater, while the surface evaporation is less. The difference is greater in proportion to elevation, and Professor Ebermayer assumes that the increase of rain-fall caused by large areas of woodlands, in some places, is to be attributed merely to the increase of relative moisture

within the forests. It is quite evident that a cooler temperature would require less cooling in woodlands to bring the atmosphere to the dew point.

These records show that more ozone exists in higher elevations where there is much humidity, and less in the midst of a dense forest than in adjoining fields.

It has long been known that plants derive their carbon chiefly from the carbonic acid always present in the atmosphere, and that by this vital process in the leaf, the oxygen in combination is released. As carbonic acid gas is a product of respiration, combustion, and fermentation, it might accumulate in deleterious excess, but for this compensating analysis in plants, by which an element essential to life is supplied. By the laws which govern the diffusion of gases, and by the action of the winds, this process of amelioration is extended over a wide region, and is felt in the distant city, as well as the immediate neighborhood.

It can scarcely be doubted but that woodlands thus tend to promote the public health, and that some benefit may result from parks and belts of woodland near the great cities, from this cause.

Electrical Conditions. — There can be no reasonable doubt but that groves and woodlands exercise a notable influence upon the electrical conditions of the atmosphere, but it remains to be demonstrated, by future researches, as to what effect this may have upon the public health. We know that there can be no evaporation, no condensation of vapor, no expansion or contraction in any form; in short, no change of place in nature without a disturbance of the equilibrium of electrical forces, and that when this is not conveyed away by conducting bodies, it will be shown by the electrometer and sometimes to our senses. We further know that electricity is dissipated by points; and that an insulated branch of a tree cannot be charged, so as to manifest the presence of electricity for many moments after the connection with the prime conductor is withdrawn. When we consider the millions of points raised high in air, bristling from every leaf, and thorn, and pubescent fibre, on the foliage of a single tree, we may well believe that the general result must favor the rapid equalization of electricity, whenever, from any cause, its equilibrium is disturbed.

A house surrounded by high trees is seldom struck by lightning, and in the vine districts of France it has been observed that vineyards are more liable to injury from this cause, where the timber has been cut away. If it be proved, as maintained by high scientific opinion, that hail-storms are of electrical origin, this view of the importance of trees in equalizing atmospheric and terrestrial electrical perturbations, acquires a double value.

The agency of woodlands in fixing drifting sands, and in intercepting and breaking the force of ocean winds, is obvious, nor can we fail to see therein an important relation to the public health, as well as great advantage in an agricultural point of view. Still greater benefits are promised in climates where the Australian gum trees (*Eucalyptus* of various species) will thrive, if half that is said in their favor proves true. It is claimed, concerning them, that when planted in marshy groves, they absorb and evaporate the moisture of the soil, so as to serve as a measure of drainage in a notable

degree, while the foliage emits a balsamic aroma, tending to counteract malarious effluvia, and to render the atmosphere salubrious around them. It is an unfortunate circumstance that the Eucalyptus grows only to perfection in a very warm climate, and that its range with us is limited to the southern border of the Union, and a part of California.

The hygienic and curative influence of a pine forest, in the case of persons predisposed to phthisis, and in the incipient stages of that disease, has been claimed by some, and deserves more careful observation.

But although we find many benefits to the public from the presence of sylvan shade, there is a limit beyond which we should not pass, — a kind of golden mean between too little and too much, and no country or people is so fortunate as that wherein this due balance is carefully maintained. With too much, we have a cool, humid climate; with too little, we have a climate liable to alternate extremes of heat and cold, — to unreasonable and excessive floods and to destructive drouths, with all the adverse effect upon the public health and human happiness which these conditions imply. Passing rapidly from the side of excess, we have already, in many parts of the country, begun to realize the evils presented in the other extreme, and may find them much more difficult to overcome. Perhaps nothing short of actual want, and the high prices which scarcity is sure to bring, will ever thoroughly arouse our people to a realizing sense of the necessity of timber culture, and our only hope of its success, then, lies in a sublime faith in that trait in the American character, which is sure to be manifested, whenever it appears that there is *money* in it.

Although we claim many benefits to the public from sylvan shade near the large centres of population, there is a limit which we should not pass. A house too densely shaded is too dark and too damp for health. Its free ventilation is obstructed, and sometimes the larvæ of insects and other direct annoyances, render trees too near a dwelling little better than nuisances. This is eminently true with respect to narrow streets in cities, where sunlight and the free circulation of air are more needed than shade.

Business often requires as much light as possible, and hence a thoroughfare of trade, or a seat of manufacture, might be seriously incommoded by the shade of trees. But along the wide avenue, upon plats of ground reserved for public enjoyment, and in the open grounds of suburbs, inviting opportunities are presented for the display of good taste, and for refined enjoyment, in the cultivation of trees best suited to the conditions, and of greatest service for ornament and shade.

The municipal authorities in many of our cities have been wisely intrusted with the care of shade trees in public streets, so that the owner of the adjacent ground may not plant or remove whatever tree he pleases; but under the right of eminent domain, the public agents are empowered to control these measures for the public good. This imposes upon those intrusted with these duties a grave responsibility, which, if realized, will lead to a careful study of the principles involved, and, if rightly improved, will result in great good.

With reference to city parks, I cannot too strongly commend the plans

that seek to give the greatest benefit to the greatest number, and within easy reach of the humbler classes, that stand in greatest need of their refreshing and refining influences.

Were the alternative presented between a grand public park, in one mass, adorned with all that could charm the eye and cultivate the most refined taste, yet from distance or regulation accessible only to the wealthy; or, on the other hand, a series of small reservations scattered here and there within easy reach of the masses of the population, connecting by shaded avenues, supplied with fountains and resting-places, and tastefully improved with such imitations of wild rustic scenery as opportunities allowed, we think the true philanthropist would not for a moment hesitate in the choice which should confer the greatest happiness upon the greatest number. If we can afford both, very well. If not, then let those having means seek their opportunities where they can readily find them, in more distant places of fashionable resort, where interest is sure to create attractions for those that pay.

Finally, but not least, I will briefly notice an effect upon the public health which may be fairly claimed for groves and trees, in the cheerful and tranquilizing influence which they exert upon the mind, more especially when worn down by mental labor, or convalescent from sickness; and this simple remedy alone might, if seasonably applied, save the lives of thousands of infants, who, for the want of the fresh air of the fields and groves, are every year dying in the crowded quarters of our great cities. The contact with nature, in such cases, has often a renovating and restorative power of positive value, and which every medical adviser must have witnessed with great satisfaction. Permit me to cite a case in point, and with this I will leave the subject to your consideration. Over twenty years ago, while engaged in a historical study, I became interested in tracing the origin and condition of a remnant of one of our Indian tribes, — the St. Regis Indians, living on the south bank of the St. Lawrence, on the line of forty-five degrees north latitude, partly in the State of New York, but mainly in Canada. In 1855 I took an opportunity of personally enumerating the families living on the American side of the boundary, as a part of the State census labors then in my charge, and I found them numbering 413. Ten years later (1865) they were enumerated by a man of my own selection, and I know he did it well. He found the number 426 — an increase of but 13. In the month of June of the present year, I accepted an invitation of our State officials for again taking their census, as an opportunity for studying the growth of a people who long ago had made me an honorary member of their tribe; and personally, with a guide and interpreter, I visited every family, and carefully enumerated every person. The number was 737, an increase of 311, or over 73 per cent. in ten years! There had been no immigration whatever, and the tables showed these increasing numbers in the multitude of children under ten years of age. Here was a study, and the solution was not difficult. Some thirty years or more ago, these people had been permitted by a State law to lease their lands for twenty-one years; and the privilege was granted to many white persons, who cleared small farms,

and made improvements, which they were obliged to leave when their leases expired. The Indians coming into possession had moved out of their squalid village, and had become small farmers, with an abundance of farm produce for subsistence, and plenty of pure air. As many children had been born before as there had been since, but they had nearly all died.

This striking argument in favor of pure air and rural life should not be lost upon those who would benefit their fellow men. We cannot remove the humble poor of our great cities away from the labors by which they earn their daily bread, nor plant them upon farms, like the Indians of St. Regis, but we can provide them with sylvan shade and fresh air, within easy reach ; or means of cheap transit to such places, whenever their wasted energies require. More especially is this needed for those of tender age, who pine and die in the crowded tenements of our cities from the want of pure air, and the invigorating inspiration of rural life. In this direction lies our greatest hope of future benefit to our crowded cities, towards which, by the imperative demands of business employment, the surplus of our population is steadily and increasingly tending, by the law of necessity, as uniform and unavoidable as that of gravitation itself ; and which, if we cannot prevent we must endeavor to control, or, so far as possible, alleviate.

Now, the fresh air and rural scenery, to which we should invite the classes most needing their invigorating influence, are not to be sought in sunburnt fields and naked sands, but in cool groves, enlivened with the song of birds that there find a safe resting-place and their subsistence upon the insects that harm by their excessive numbers, when not repressed. The wasted energies of life are renewed by communion with nature in her wild and rugged forms, which gain new interest when brought in near contrast with the improvements of the city, and scattered here and there near the marts of trade and the beaten paths of industry. Let us, then, bring home glimpses of nature from the wildwood, to relieve the monotony of city life, if by so doing we refresh the weary, and make existence enjoyment, where but for this timely provision it might prove a burden.

PRIVY-VAULTS AND CESSPOOLS.

By B. A. SEGUR, M. D.,
Late Sanitary Superintendent, Brooklyn, N. Y.

STATEMENT PRESENTED TO THE ASSOCIATION IN A DISCUSSION ON SCAVENGING AND SEWERAGE.

Privy-vaults and cesspools continue to be used in Brooklyn, notwithstanding the general introduction of water and sewers. Not less than forty thousand houses depend upon privy-vaults and cess-pools, and a very large proportion of the houses which have water-closets also have privy-vaults in the yards for the use of servants. The construction of these vaults differs according to location and other circumstances; some are simply wells, more or less deep. In extensive localities, with low grades, with reference to tide-water, there is a constant free circulation of liquids between the vaults and the soil; and generally, in the wet season, vaults not made water-tight are full or partly full of water, flowing into them from the saturated soil, then flowing out, saturated with excreta, into the surrounding soil as the level of the ground-water sinks, soaking the ground with filth. Other vaults are laid in mason work and connected with the sewer. The drain or connection between the vault and the sewer is placed two, three, or more feet above the bottom of the vault. The regulations of the Water Board do not permit either service-pipe, hydrant, or kitchen-waste water to enter the vault. The only water for cleansing or carriage of the contents of the vault into the sewer is the rain-water from the roof of the house. When the solids have accumulated in the vault up to the level of the drain, a small portion may be conveyed to the sewer, but the practical working is, that the vault fills up full and overflows, and the services of the scavenger are required more frequently in those connected vaults than in the kind first described.

The effect of both sewered and unsewered vaults is the same, — the retention and accumulation of excreta. The fæces and urine retained in privy-vaults promote, hasten, and intensify the chemical decomposition each of the other. Water also aids the putrefactive processes. Then offensive and injurious gases and effluvia are given off and circulate or stagnate in the atmosphere according to its state of moisture, motion, etc. These vaults are necessarily near dwellings, and when the city lot has a front and a rear house standing on it, the privy-vault is between the two. In this space the atmosphere is always offensive. If the doors and windows are open, the inhabitants breathe animal matter in appreciable quantities with every breath. Our educated feeling of decency requires filth to be invisible to one of our senses, but permits it to assail another sense, not only in the

near vicinity of tenement-houses, but of a very large majority of all classes of dwellings in town and country.

Directly from the vaults and indirectly through ground-soakage, the atmosphere is contaminated and in such measure, that vital forces are lowered and diseases are multiplied and intensified. The amount of ground-soakage from these *depots* of *putrescible* matters in old towns has hopelessly contaminated the soil.

In our cities, given a filth-sodden, undrained soil, with the alternating rains and drouths and the tropical heat of our summers, and we have, as a consequence, the annual scourge of our endemic, diarrhœal diseases; as in similar circumstances and conditions the populations along the Ganges, the Nile, and the Mississippi, are scourged by the cholera, the plague, and the yellow fever. It is consistent with the accepted doctrines of the causation of diarrhœal diseases, typhoid fever, dysentery, diphtheria, and other zymotic diseases, and with the experiences of sanitary administration, that this association should declare: —

I. That typhoid fever, cholera, and yellow fever are fæcal diseases; that putrefying and decomposing animal and vegetable matters are either direct causes of, or powerful aids to, the propagation, diffusion, and mortality of diphtheria, scarlet fever, and all the zymotic diseases, and that especially the vigor, vitality, and power of resistance to morbid influences of infants and children are everywhere, but particularly in cities, impaired to a degree only to be fitly represented by the numerical statement that, while the population under five years of age is only one eighth of the total population, the mortality of children under five years is one half of the total annual mortality from all causes and three fourths of that from zymotic diseases.

Excrement accumulations are not only dangerous when and because in a state of decomposition, but they are seed-beds of disease-germs, which once deposited in the evacuations of infected persons, are rapidly multiplied and either, by means of soakage, reach the well; or by circulating in the atmosphere, communicate their special infection to persons, and thus cause epidemics of typhoid fever, etc. Every case of typhoid fever must be considered an evidence of a germ and of its conveyance to the person sick, probably through bowel-discharges from some person. An investigation should always follow, with the definite object of discovering the ways in which either the air or drinking-water may have been poisoned by excretion.

II. Privy-vaults and cesspools are the most prevalent and active forms in which disease-producing filth is found in cities and villages. The yearly accumulation of fæces and urine in a village of 1,000 people is about 25 tons of the former and 91,250 gallons of the latter. It is an accepted sanitary and engineering doctrine, that this filth should be removed before decomposition begins; that is, no accumulation should be permitted, and the manner of the removal, so that it be immediate, is a question of detail. All accumulation and retention of putrescible matters in towns to be prohibited, and all privy-vaults and cesspools abated as nuisances, dangerous to life and detrimental to health.

III. When the necessity for the daily removal from their habitations of all putrescible and infectious waste and excreta is admitted by a community, we may believe that the way to do it will be discovered. No doubt it will, for a long time, be a costly public service. Even an exhausted soil near to cities, may not be enough benefited by the cities' waste to pay the cost of the frequent removals. It is important that all concerned should understand that such removals are imperative, in the interest and for the preservation of life and health and for the prevention of epidemics; and that, for the present, all promises of money-profits from this work are delusions. It cannot be done, by any method now known, without costs. Expectations may be excited in favor of some fallacious method, delaying practicable improvements, when actual working plans are all found to increase taxes. Nevertheless, a better appreciation of the necessity will surely bring a better scavenging of towns, because prevention is cheaper than remedy, and the highest sanitary authority assures us that the removal of filth from habitations would effect an annual saving of tens of thousands of lives in England alone.

SUMMER RESORTS FOR THE DEBILITATED CHILDREN OF OUR CITIES.

By JEROME WALKER, M. D.,

Late Attending Physican to the Sheltering Arms Nursery; Physician to St. John's Hospital, Brooklyn, N. Y.

It is my purpose to briefly call attention to the influences demanding attention in our cities, during the hot weather, in the care of the thousands of children within their borders; to state, as far as possible, what has already been suggested or accomplished, and to arrive at certain conclusions. The mortality in our cities during the hot weather is increased from fifteen to twenty per cent., and especially among the young, the feeble, and the old. Healthy babies and children give way under protracted or excessive heat. The weaker ones succumb — what can we say more as to those already weak, when the heat comes, than that the mortality is frightful. As the thermometer marks 80° F. and above, food deteriorates, and milk, which should be the basis of the child's diet, till two years of age, is likely to undergo changes, unfitting it for digestion. High temperature, also, relaxes the mucous membranes, and diseased conditions of the alimentary canal, beginning at first as mere disordered digestion, are common; twenty-five per cent. of all the deaths are from these complaints.

Over-feeding, and sometimes even the normal diet of a day of temperate heat, under the influence of high temperature, produces sudden projectiles, vomitings, and purgings, with excessive debility. These results occur in nursing children, as well as in those that are fed, but largely in the stifling air, the overcrowding of inmates, the slatternly surroundings of some institutions, and many tenement-houses.

Heat enervates, and hence we have cases of nervous prostration, shown by muscular debility, sluggish brain, and atony of the stomach and intestinal canal.

Ignorance maintains, in summer, the body-wrappings of winter, and overclothing is a source of skin-eruptions. The feeble, sickly child dies the soonest, but before dying his ophthalmia may have poisoned the healthy, the fæcal discharges have produced much sickness and death. Those that survive are enfeebled, and, with reduced powers of resistance, fall easily before an epidemic or contagion, or drag slowly along to a half-way recovery. In September and October our dispensaries treat more cases of defective nutrition, marasmus, tuberculosis of the lungs and mesentery, than in any other five months of the year.

The summer vacation, to many children, is but a time of idleness, neglect, and sickness. They live in the "pig-stye" districts of the city, festering with filth and disease, or they swell the tenement-house population or live

among the better classes. Wherever they are, they are sent into the streets and vacant lots, to be "out of the way." Their food is not as carefully attended to; they are not kept as clean; they are not required to keep as good hours as when attending school.

To sum up in the fall, the results of the summer: 1. Many deaths from among those constitutionally feeble, or with acquired loss of vigor. 2. A smaller number from among the healthy. 3. A very large number of the younger children, if they live at all, remain enfeebled. Many of the school-going children are either just convalescing, or are in such a weakened condition that the seeds of any contagious disease, latent in the playfellows at school, find congenial lodgment. Hence it has been noticed, that in our cities, contagious diseases increase on the opening of the schools in the fall.

Another effect of the idleness and neglect in summer is to increase crime, to destroy moral sensibility. The atmosphere, foul with emanations, beclouds the mind and destroys the body. The cure consists in *creating* a better atmosphere, or in removing to another, among better surroundings.

WHAT HAS BEEN ACCOMPLISHED.

Not many years ago, Dr. Brochard, in charge of the Sea-side Hospital for Children, at La Tremblade, on the west coast of France, detailed, in a little work, the advantages derived by sick children from living in the salt air. Immediately, philanthropic people were aroused, and to-day there are a number of sea-side resorts in this country.

In 1872, a Sea-side House, for the poor of Philadelphia, was opened at Atlantic City, to receive cases of debility, convalescents from acute diseases — as pleurisy, remittent and scarlet fever and measles — and sufferers from scrofulous diseases, — complaints for which sea air and salt water bathing are peculiarly beneficial.

The number of patients has been as follows: —

1872. 27, of whom 11 were discharged well and 12 improved.
1873. 55, of whom 38 were discharged well and 15 improved.
1874. 138, of whom 91 were discharged well and 46 improved.
1875. 129, of whom 86 were discharged well and 40 improved.

The total current expenses have been as follows: —

1872. $1,708.77, averaging $1.53 per patient per day.
1873. 1,662.66, averaging $1.26 per patient per day.
1874. 3,569.95, averaging $1.21 per patient per day.
1875. 3,680.07, averaging $1.20 per patient per day.

Two dollars a week is charged for board, etc., but a limited number of free and partly-paid patients can be admitted. A mother with one or two children can occupy a cottage (of which there are ten) at $3.00 a week. Children from institutions are taken in at a reduced price. The funds to carry on the work have come from donations, subscriptions, the board of patients, and a bequest of $5,000.

The children admitted ranged, as to age, from a few months to fifteen

years. Invalid children of both sexes, without regard to color, creed, or nationality, are received. Daily surf-bathing is insisted on, where the children are not too feeble.

The house is under the charge of a resident physician, a matron, and a chief nurse. The conclusions of the resident physician, Dr. W. H. Bennett, as to the experiment are: "As a sanitary measure and as a philanthropic enterprise, it has been entirely successful. The change in a few days for the better has been marked, except in utterly hopeless cases."

In 1875, the Woman's Club of Boston organized to provide sea air advantages for debilitated children. A seaside home was opened at Beverly, Mass., under the charge of Dr. James Ayer, Mrs. Parker, and the Sisters of St. Margaret.

From July 9, to September 26, 1875, 133 children were cared for, and sixty mothers or relations. Over one half of the children were less than three years of age.

There were discharged, well	93
Relieved	25
Not relieved	13
Died	2

The doctor reports that the "majority of the children, showed a marked improvement within twenty-four hours after admission. Many severe cases of cholera infantum began to improve immediately after their arrival.

"If no improvement could be noticed by the end of the second or third day, it was rare for it to occur at a later date."

"It is a matter of regret that so many mothers had to be admitted, as only a small proportion were able to nurse their children."

The expenses for the summer were $2,588.85.

Short steamboat trips were inaugurated by the managers for those not able or willing to go to the home, the tickets being given out mainly by dispensary physicians.

In 1875, the Children's Aid Society of New York opened a "Home" at Bath, L. I., which has cared for, on the average, one hundred children each week, or 1,453 during the summer just closed. The same year, the West Side Relief Association of New York rented places at Malden, N. J., and afterwards at Fort Rockaway. Twenty-five cents cares for one child, at either of these places, for one day. A donation of $100 will send one hundred children to the Sanitarium for one week, and care for them there. One thousand six hundred sick children and their mothers have been cared for, during the past year.

A few years ago, a Mrs. Anson Phelps Stokes, at her own expense, opened on Staten Island, a "Home" for the summer. It was under the charge of Dr. Walser, of New Brighton. The experiment was successful.

During the last year, another has been started on Raritan Beach, and one has opened its doors to the poor of Newark, N. J., at Greenwood Lake.

In 1874, the Brooklyn Children's Aid Society, having cared for the children of the Industrial Schools, and of the city, as far as possible, by fresh-air picnics, proposed to erect a Sea-side Home. Through the persistency of

Mr. Wm. Kirkby, and the earnest coöperation of the general superintendent, a building was erected on the pavilion plan, in 1875 — the expense being borne by one gentleman.

From July 11 to August 26, 1875, 442 children and 139 mothers were received, most of them staying one week. Sixty-seven of the children were under two years of age; "six of these were in the last stages of marasmus, and did not rally, except for a day or two." "In all the others, marked improvement was rapid." This statement bears out the observation of Dr. Ayer, of Beverly.

The cost of maintaining these 581 persons for seven weeks, was $1,000, probably more than will be spent in the future, as experience ripens.

The admirable work of the floating hospital of St. John's Guild, is of the same beneficent character, devoted to the relief of poor children suffering from the effects of summer heat, their mothers and nurses being permitted to accompany them in a quiet sail on the river or bay; well cooked, nourishing food being provided both for the children and their mothers or nurses who accompany them each day.

St. John's Guild of St. John's Episcopal Church, organized ten years ago, to care for the poor, had then a membership of twelve, and annual receipts of $1,000; now there is a membership of five hundred, and the receipts for the last year were $60,000.

In 1873, the Guild hired a barge, and gave two excursions for sick children. In 1874, eighteen excursions were given, and 15,202 sick children and mothers cared for. In 1875 a floating hospital was constructed, capable of holding 2,500 sick children and mothers, and 22,830 were taken out in the twenty-two excursions which followed. The cost of an excursion for 1,200 persons is $250; this provides two substantial meals for the mother, and properly prepared food for the sick children, besides paying the running expenses. The floating hospital is no longer a philanthropic theory but a *humane fact*."

Chicago has also given "fresh-air picnics."

We must not omit mention of St. Johnland, L. I., the realization of Rev. Dr. Muhlenburg's "dream-land" for the sick and feeble. Many a mother has found life for her dying child within its borders.

INLAND RESORTS.

In 1872, Dr. Toner of Washington suggested free parks and camping grounds, as Sanitariums for the sick and debilitated children of the cities. He has been warmly seconded by Dr. Hartshorne of Philadelphia, who has shown the plans to be feasible, and economical to the State. These parks were to cover one thousand acres or more, elevated above the influence of malaria, to be laid out as a well-ordered village, and to be under the charge of a medical and civil police.

Ground has been donated by Johns Hopkins of Baltimore, for such a purpose. So far, this is all that has been done in that direction.

Camp meeting associations throughout the country have charge of pleasant, healthy resorts. Many families spend considerable time in them, but, as a rule, the cost of living is as great as in the cities.

The movement inaugurated in Copenhagen, known as the "Country Week" system, by which the children of the poor were cared for in private families in the country for one week at a time, has been followed out in Boston and vicinity with the best results during the past year. "Fifty-one families in all opened their doors in welcome, usually accepting couples and to stay one week." In several towns the people organized "Homes" for a stay of a week or two, caring for nearly one hundred children. To these country resorts the children go alone. Guarantees were needed, when a child was proposed, of character, cleanliness, and real need of the country week. The teachers of the public schools, of Sunday-schools, and of children's homes, were applied to to send cases.

One hundred and sixty of these children guests were sent out, three fourths of the number being girls. The ages ranged from six years to fourteen. The cost per child was from $2.00 to $3.00 per week, and will be less in the future.

The Society, careful in its selection of children and of families that agree to accept a charge, were able to place these children under the very best influences, moral and hygienic. The week's stay taught the city children much, and aroused interest in the families extending hospitality.

CONCLUSIONS.

There are four classes of children to be provided for in our cities during the summer months.

1st. Those whose parents are able to pay liberally for summer board and country advantages.

2d. Whose parents can pay a moderate price, constituting the middle class.

3d. Whose parents through reverses can pay nothing, and those whose parents would not pay if they could, constituting the real pauper and sponging class.

4th. Children in Institutions.

For the first class, are yet to be started Summer Homes, under the care of competent physicians and nurses, where fresh vegetables and fruits, milk and substantial food can be had, where ice is not a luxury, where there is quiet and rest for the enfeebled little ones, where accommodations can be had for gentlemen, desiring to visit their children. Hence these homes are to be near the cities.

The second class could be provided for, perhaps, on the same grounds, at reduced prices, and yet have comfort and necessities.

The third class to be cared for in free parks, "country week" homes, and sea-side homes, supported there by churches, schools, benevolent societies, and charitable organizations. Children in institutions, especially nurseries, if for no other reason than to give an opportunity to change thoroughly the inside air, should be sent into another atmosphere. In fact, nurseries should not be cramped in cities, but have receiving houses only, for transfer, or for temporary stay.

1st. As, on the average, the effects of malaria do not exist 500 feet above the sea level (and certainly not at 1,000 feet), and as malaria has much to

do with nervous prostration, sanitariums should be located with reference to this point, amongst others.

2d. The strong, rarefied air of mountainous districts, and the sudden damp winds prevalent along the sea-coast, are unfavorable to debilitated children with weak or diseased lungs. In either situation the greatest care is needed, and children should wear flannel. A very suitable carriage-garment for babies is a loosely woven woolen bag, to be drawn over the feet and body, and fastened under the arms.

3d. Scrofulous diseases and summer complaints are wonderfully relieved by a change of air, — the first by sea air ; and as to the latter, there are no data to point out the relative value of mountainous and sea air. A good general rule to follow is, for inhabitants of the sea-coast to go to the mountains, and vice versa. If a child does not begin to improve within a week at either place, it is best to change.

4th. These summer homes need even better nurses than ordinary institutions, and it is not economy to have attendants because they are cheap.

5th. In choosing sites for homes, the ground should be sloping and well drained, the privies not less than one hundred feet from the building for inmates. Dry earth should be freely used in them, or in earth closets, which might well take the place of some of the present abominations. Trees, with their influence to ward off malaria and soak up moisture, should be near at hand. The buildings, especially if on the glaring sand beach, should be painted of a dark color, and should have wide, open piazzas. The food should be selected with reference to variety and wholesomeness. Milk, the cereal grains, fresh vegetables and fruits, should be the main diet ; meat or fish to be given but once a day.

6th. As in effecting reforms, education of the people is necessary, Dr. Stephen Smith's suggestions are valuable : " Found a central Ladies' Sanitary Association, with branches in every church. Let there be a ' Sanitary Sunday,' in which collections can be taken up in the different churches, in aid of the work."

In the sanitary work, as in other kinds, much valuable labor is lost for want of system. The field is occupied, but there is no commander to direct. The State Charities Aid Association grapples with the question of pauperism ; the Social Science Society with social questions ; the American Public Health Association with health questions ; and yet there is need of definite directions as to diet and sanitation to be sown, broadcast, among the people. Why not have a combined plan of work. Surely, by this time, the main sanitary questions are settled by the majority of thinking men and women.

In conclusion I offer the following resolution : —

Resolved. That the President of this Association, together with the Executive Committee, appoint a committee of five, to confer with the State Charities Aid Association, and other reputable associations for the advancement of health, or the elevation of the poor, in reference to a combined work, in the care of debilitated children of the cities during the hot weather — the committee to report at the next annual meeting of the Association.

A REPORT ON METHODS OF VENTILATION AND THE PERFECT VENTILATION OF HOSPITAL WARDS.

By CARL PFEIFFER, F. A. I. A.,
New York.

READ AT THE ANNUAL MEETING IN BALTIMORE, NOVEMBER 11, 1875.

In reporting upon the systems of ventilation, I have endeavored to obtain the results of experiments and experience of the best authorities, such as Prof. M. Pettenkofer, Dr. Grassi, Peclet, Morin, and many others. While much ingenuity is exercised and the means employed to accomplish ventilation are various, the systems upon which they are based are known, first, as that of natural or spontaneous ventilation ; second, of ventilation by aspiration or extraction ; and third, that of propulsion or mechanical ventilation.

Natural ventilation is based upon the difference of the outer and inner temperature, and, consequently, also upon density of the interior and exterior air. To produce a sufficient velocity in the evacuating and supply flues, so as to insure an efficient renewal of the air, the difference of temperature must be considerable. The primary force which produces motion in spontaneous ventilation, is the difference of specific gravity of two columns of air. In the same degree this difference of temperature is lessened between the inner and outer air, the velocity of the current will be reduced ; should the exterior air be equal in temperature to that of the interior of a building, no movements of air will take place.

Degen (*Handbuch der Ventilation und Heizung*) states that by a difference of from 30° to 40° a sufficient ventilation may be secured, a result that may be obtained in winter, but not in the spring, summer, or fall ; "in these seasons," the same author says, "the system of natural ventilation has been found to be insufficient, and if a constantly operative ventilation is required, it will be necessary to employ mechanical means to secure it." It seems necessary, for these reasons, to employ machinery to set the air in motion ; the opening of windows will not be sufficient.

Pettenkofer found that, through a window opening of 9½ square feet, a supply of only 14 cubic meters of air was received during one hour, and by the entire open space of an ordinary window, the requisite quantity for two persons only could be obtained (60 c. m. per hour being considered necessary for one person). To demonstrate how variable the results are of natural ventilation, I need only refer to some of the experiments of Dr. Pettenkofer, made during the months of March, October,and December. At nineteen different trials he found the changes of air in the same room, of which he was the only occupant, to vary from 69^3 to $1{,}009^8$ cubic feet. In the former case there was no difference between the exterior and interior tem-

perature, while in the latter the difference was 19°. In addition to the above, Pettenkofer made 220 experiments in the Lying-in and in the General Hospitals at Munich, by request of the Bavarian government. The ventilation of these buildings was based upon the natural system. He found during 100 experiments that it was entirely inoperative, and during 100 other experiments, the action in the flues was the reverse of that which it was intended they should have been. This, then, seems to demonstrate the insufficiency of the system where a permanently active change and an unvarying supply of air is required, as in hospitals, asylums, prisons, schools, etc. In connection with this system, it should be remarked that the velocity of the current of the exterior air exerts a marked influence upon the ventilation of a building, as it has been found that much more fuel and heat is required when it is cold and windy, than during calm, cold weather.

The second system is that of "Aspiration or Extraction." This system has, perhaps, nowhere had a fairer trial than at the Hospital La Riboisière, at Paris. This hospital was completed in 1854. The authorities being very desirous that it should be well heated and ventilated, prepared a programme containing the conditions which should be fulfilled by proposals which were to be invited. The programme, according to Dr. Grassi (*Étude Comparative des Deux Systemes de Chauffage et de Ventilation etablis à l'Hopital La Riboisiere*), contains the following thirteen conditions: —

I. A constant temperature of 15° Centigrade (59° Fahr.) in the wards during the whole year, by day and night.

II. A temperature of 15° C. (59° Fahr.), during the whole year, in the daytime only, in the offices and rooms.

III. A temperature of 10° C. (50° Fahr.), the whole year, by day and by night, on the stairs of the pavilions of the sick.

IV. A constantly operative ventilation by warm air in winter and by cold air in the warm season, the supply of fresh air to be at least twenty cubic meters per hour and per bed in the wards.

V. A ventilation, during the daytime only, of ten cubic meters per bed in the private rooms of each pavilion.

VI. A ventilation in the water-closets sufficient to prevent, under all circumstances, the development of bad odors, and without creating currents which might prove injurious to the patients.

VII. The ventilating apparatus to possess a surplus of power sufficient to produce in some, or all of the wards, twice the amount of ventilation before prescribed, in case it should be found necessary during a great epidemic to increase the number of beds.

VIII. The ingress openings of the fresh-air flues to be of sufficient transverse section to admit the air into the wards with but little current, and at a temperature not exceeding 70° Fahr.

IX. The air must enter the wards in the requisite degree of moisture, susceptible, however, of being changed at pleasure.

X. An especial contrivance for cooling the air artificially, when necessary, during seasons of great heat.

XI. The apparatus for the general heating, or special apparatus to furnish

a sufficient quantity of warm water to answer all requirements of the wards, and to maintain an efficient temperature in the hot closets of the ward kitchens.

XII. In every kitchen of the basements, either in connection with the warming apparatus of the kitchens of the upper stories, or separately, provision must be made for maintaining an active fire.

XIII. The heating and ventilating apparatus to be contrived so as to admit of being gradually put in operation in all parts of, or to be discontinued in any portion of, the buildings; besides, the apparatus must permit the lowering or raising of temperature of the wards.

A commission, composed of scientific men of accepted authority, and presided over by the well-known physicist and chemist, Regnault, examined the various proposed plans and methods and decided in favor of forced or fan ventilation, as proposed by Thomas & Laurens, of London. This decision created a general dissatisfaction and strong opposition. This method had not been in use in Paris. The system of aspiration, so well contrived by Leon Duvoir, had produced favorable, though not entirely satisfactory, results; but its advocate so strongly attacked the decision of the commission, that a second one was formed, composed mostly of architects, under the presidency of General Morin. The latter made the proposition assented to by his associates, to heat one half of the number of pavilions by the system of aspiration, as proposed by Leon Duvoir, and the other half by the system of propulsion, as proposed by Thomas E. Laurens. The demand upon the ventilation was increased from twenty to sixty cubic meters per hour and bed for both systems. It has been conceded that the operation of these two systems was investigated in a most thoroughly scientific and impartial manner by Dr. Grassi, during a period of two years. In the experiments of the system of aspiration he put to himself several questions, which, in the opinion of Professor Pettenkofer, were answered with scientific precision. Among these were, 1st. Is the amount of air which passes through the extracting chimney equal to the amount of fresh air supplied by the flues intended for this purpose? By measuring with the anemometer, he found that ninety-three cubic meters of foul air passed through the chimney per hour and per bed, while only thirty-one cubic meters of fresh air came in during the same time through the fresh air flues, instead of sixty cubic meters, as prescribed, and the difference of quantity was supplied by the doors and windows.

Dr. Grassi found during various experiments an analogous result. Question 2d. Is the system of aspiration uniform during the entire year? The result of his experiments obliged him to answer these questions most decidedly in the negative. The motive power being the difference of temperature of the extracting chimney and that of the open air, and as this difference was at times more and at other times less, so also he found the ventilation to vary. Consequently, the system of aspiration was declared by Dr. Grassi to be faulty and insufficient. In connection with the system of aspiration, the construction of the ventilating shafts, flues, and chimneys is of great importance. I have learned by experience that it is not sufficiently observed by people who have such matters in charge, whether the movements of air

are produced by static pressure or by suction. It is ultimately the general pressure of the atmosphere which produces the movements of air, whether in consequence of the disturbed equilibrium or by a vacuum created by suction. A chimney flue does not act as a bellows and the general expression — suction of the air by means of a chimney — shows most unmistakably the erroneous conception of aerostatic laws by laymen in physic. Physicists have furnished the most decisive proofs that the so-called draught in a chimney is not produced by the tendency of the warmer columns of air to rise within it, but by the pressure of the colder lower strata of air, for the same reason that causes oil to rise in water.

The third system, that of propulsion, being in use in the other half of the La Riboisière Hospital buildings, was submitted to the same careful test by Dr. Grassi. While the programme demanded a supply of only 60 cubic meters per hour and bed, he found that in the pavilion nearest the fan 132 cubic meters were furnished per hour and bed; in the second, 126 cubic meters; in the third and last, 88 cubic meters were furnished, or an average supply of about double the quantity demanded. Grassi tested also the barometric pressure of the air in the wards in comparison with that of the open air, and found the former less compressed than the latter, so that considerable additional air passed into the wards by the joints of the windows and doors. Notwithstanding the excessive supply of air, no draughts or unpleasant currents were perceptible a few feet from the openings. It was also found that in the wards ventilated by this system, the carbonic acid was only 1.1 per mille, while in the former it was 2.5 per mille of the volume of air. Professor Pettenkofer, who was commissioned by the Bavarian government to examine the ventilation in use in the public buildings in Paris and London, has verified the conclusions of Dr. Grassi, and states in his report that the experience and tests made at La Riboisière were perfectly convincing as to the superiority of the system of propulsion or mechanical force in ventilation, and recommends it as the only reliable method. As it has been a point of considerable dispute and discussion whether a fan should be placed so as to extract the foul air or to force in the fresh air, Dr. Pettenkofer gives the results of experience as well as investigation of this matter at the Hospital Beaujon, in Paris. Here, the fan was originally placed in a chamber in which all the foul air flues terminated, and contrived so as to extract the foul air, leaving the supply of fresh air to take care of itself. This, however, proved a complete failure, and it was found necessary to change the position of the fan, and reverse its operation, so as to force in fresh air. Professor Pettenkofer closes his reports with the opinion that the natural system of ventilation is irregular and accidental and not to be recommended. As to the system of aspiration, he says that it cannot be denied that a good ventilation may be attained by it; but it is more or less irregular and will vary with the difference of temperature in the extracting chimney and that of the open air. He refers to Peclet as having given the clearest and most convincing proofs of this in his report of the ventilation of the Mazas prison. He concludes by recommending forced ventilation as the only reliable method, inasmuch as the requirements of our lungs

are constantly the same; that it is our duty to employ the means by which we will insure the supply of this demand. He says that it is of the utmost importance to furnish a sufficient supply of fresh air, and when this is done, but little attention need be paid to the expulsion of the foul air.

Peclet, who devoted a lifetime to the study of physical sciences, and who has been called the father of the new science of applied physic, and whose works are perhaps the most authentic on everything that appertains to the phenomena of heat, has expressed almost the same views as Dr. Pettenkofer.[1]

General Morin, in his work upon heating and ventilation, gives the results of investigations in these matters in several of the manufacturing establishments of Paris, where the atmospheric impurities produced were very great, as showing that the recent trials seem to demonstrate that the system of ventilation by propulsion was the most effective. A German author, in reviewing General Morin's work, and noticing this passage, says the advocates of this method could not desire a better testimony than this, as it comes from a hitherto most strenuous opponent of that system. Dr. Seifert, of Dresden, to whom was awarded the first prize by the Imperial Academy of Vienna, for an essay on the construction of asylums for the insane, and who visited the institutions of Germany, France, England, and other countries, arrived also at the conclusion that mechanical ventilation was the most perfect. The Convention of Superintendents of American Asylums for the Insane, declared by resolution in 1851, and reaffirmed the same in May, 1853, that forced ventilation, or the use of a fan, was the only method to be recommended for their institutions. A number of eminent English authors have advocated the same method, and I might name yet a considerable number of other authorities.

[1] The views of Peclet have been cited by Dr. Parkes in his *Practical Hygiene*.

THE GASES OF DECAY AND THE HARM THEY CAUSE IN DWELLINGS AND POPULOUS PLACES.

By Professor WILLIAM H. BREWER,

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A PAPER READ AT THE ANNUAL MEETING, BOSTON, OCTOBER 6, 1876.

In these latter days so much has been said about the gases of decay and their relations to health and disease, that I can hardly hope to add anything absolutely new. I only hope to call attention to some chemical phases of the subject which I think important to keep in mind in the practical treatment of the sanitary questions they relate to, and to make these the hooks upon which to hang a few questions about the best methods of ventilating sewers.

What chemists call "organic" substances, in nature, are all the products of life, directly or indirectly. They are vast in number, and of wonderful variety of character and composition, agreeing only in this, that they all contain carbon combined with oxygen, nitrogen, or hydrogen, sometimes with other elements, of which only sulphur and phosphorus, or, indeed, only sulphur, need here be considered. All organisms, unless of the very lowest forms, are built of a considerable number of complicated chemical compounds, which, when brought under other conditions than those which produced them, have a tendency to decompose, and, if the conditions are favorable, to be resolved again into their original elements, or else, into certain simpler compounds which are called "minerals." Now, this decomposition in nature we call *decay*, and in its sanitary relations it may be considered in two stages: —

1st. The more complex chemical combinations break up into those of simpler formulas by a rearrangement of the molecules.

2d. All these resulting compounds ultimately return to their elementary condition, or to oxides.

If the original organic compound or organism contained much nitrogen, and the right conditions of moisture and temperature exist, we have what is called putrefaction and stinking gases are evolved, — the term putrefaction being a popular term rather than a scientific one. The stinking gases are without doubt mostly organic compounds, and may be destroyed by oxidation or further decomposition. In nearly every stage of the process, there are resulting compounds which may be the food of new organisms, animal and vegetable, particularly the latter, some of which act in such a way as to hasten the change, as in the case of ferments and many fungi. Others simply use such compounds as food, without otherwise affecting the source of it. In either case, the natural decay is arrested or modified so far as the

compounds which are used by the new beings are concerned. When not thus arrested, the process goes on until the mineral matter is returned to its original "dust" and the remainder into gases. This last is, indeed, very much the larger portion. The ultimate products are comparatively few; but, during the process, many compounds are produced, some of which are gases, — the gaseous mixtures being complicated ones, — and the experience of ages has shown that some of these gases or their mixtures are hurtful to health.

In a comparatively few cases we can see a chemical reason for this, but in a vast number we have the fact while the process is yet secret. A few of the gases of decay are well known to chemists; they have been isolated; we are familiar with their properties, but they are mostly those gases formed in the later stages. Carbonic acid, ammonia, marsh gas, sulphureted hydrogen, nitrogen, possibly carbonic oxide; these are all well enough known, two at least are disagreeable to the smell, and some of them are harmful to the health if present in the air in any considerable quantities. Neither of these produce the diseases prominently associated with filth gases; they certainly do not generate such diseases, nor is it proved that they are especial carriers of their germs; nor indeed do they specially aggravate the symptoms of such diseases more than any other unwholesome condition does. Morever, it is not proved that any or all the gases I have mentioned (unless it be sulphureted hydrogen) occur in our houses in sufficient quantities to be very hurtful except in rare cases. I use the old and well known names for the gases rather than the new ones, most of us being more familiar with the term carbonic acid than with carbonic dioxide, and so of the others.

Regarding sulphureted hydrogen, we know that it is poisonous, and its action on arterial blood is a common lecture-table experiment. Yet I cannot but think that its unhealthiness is overrated; we may perceive it often in the analytical laboratory, or in the neighborhood of a sulphur spring, vastly ranker than I have ever smelled it in a sewer or privy, yet the persons subjected to it do not usually suffer any considerable inconvenience. Carbonic acid is the most abundant, and is poisonous; yet when diluted seems not to be very hurtful, if generated from other than decaying substances, as about lime-kilns and furnaces. Its great interest and importance to the sanitarian is mostly in the fact that in certain investigations, such as the determination of the impurity of the air in assembly-rooms, it is the measure of other impurities. In such cases, its proportion in the air can easily be determined exactly, while the more subtle and more hurtful accompaniments cannot be so measured. A candle in a room may consume as much oxygen, and generate as much carbonic acid, as a person; yet no one claims or believes that one man and a hundred such lighted candles in a room would make the air as unwholesome as would a hundred persons and one candle. Carbonic acid is not wholesome, but it is not the worst element in the air of a crowded room, or of the gas that escapes from a sewer or cesspool. The nitrogen contained in the original organism is, perhaps, largely resolved into ammonia, this in turn to be ultimately oxidized. As a

product of decay, ammonia is, perhaps, always in the milder form of carbonate, and only in the rarest of cases abundant enough to be especially hurtful. Where oxygen and nitrogen, as such, exist, whatever be their source, they are not poisonous; surely oxygen is not, and nitrogen is inert and negative, not positively poisonous. Phosphureted hydrogen is often spoken of as one of the products in the decomposition of animal matter, and we have stories of the will-o'-the-wisp as an alleged proof of its occurrence. I have sometimes thought I could perceive its peculiar odor in the rank stench of small animals rapidly decaying in hot weather. It is affirmed that animals or fish, rotting under water or in mud, generate it, and that it is one cause of the unwholesomeness of such exhalations. It seems to me very questionable if it is produced under ordinary, if, indeed, under any conditions in nature. With another chemist some years ago I conducted a long and careful investigation of the gases generated by fish decaying under water, one of the objects of which was to test this very matter. We failed to find even a trace of phosphureted hydrogen by the most refined tests then known. Marsh gas, or light carbonated hydrogen, is one of the products of decay under certain conditions. Inasmuch as it is known to be generated in swamps and shallow water with decaying matter at the bottom, the hypothesis is often put forth that it is an ingredient in, or even the cause of malaria. I need not say that this is mere conjecture; there is not a particle of proof, and no such effects follow the breathing of this gas when generated in the processes of the arts. If carbonic oxide is ever generated in decay, it is only under very peculiar conditions and in infinitesimal quantities, and may be disregarded in this connection.

We have now exhausted the list of gases known to chemists as being generated in the ordinary processes of decay, and none of them seem capable of producing the effects that *sewer gas* is known to produce. This last seldom gets into our houses in sufficient quantities to materially diminish the relative amount of oxygen, or to poison with carbonic acid; yet its results are not negative; it acts as a poison, and the physiological effects are unlike those which follow the breathing of any of the definite gases I have named, even of such as are known to be poisonous.

If the physiological effects which follow the breathing of sewer gas so called, are produced by actual gases, acting chemically, then these gases are absolutely unknown to chemists, and exist in too small quantities to be estimated by any known process of gas analysis. This, however, is no proof that they do not exist. The sense of smell tells us that there are organic gases and compounds never yet isolated, and of whose composition and properties, other than their smell, we are entirely ignorant. Indeed, we are ignorant of the composition of most of the *smells* of putrescent matter. In the investigation of the gases from rotting fish, of which I have spoken, the gases were very stinking, intensely so; yet the actual amount of the gas which had the odor was too small to be detected by the ordinary means of gas analysis, and these analyses were conducted under the eye, and some of them with the aid, of Prof. Von Bunsen, then, as now, the most eminent gas analyst in the world. The analyses of sewer

gases point in the same direction. The result of some experiments on the air of sewers and drains are given in the Report of the British Association Sewage Committee, 1869–70. Specimens were collected from various street and house sewers, chiefly in the Paddington District, and during August, so that there is every probability of the air being as foul as possible. They were chemically examined by Dr. W. J. Russell. The most impure air contained only half a per cent. of carbonic acid; the remainder was oxygen and nitrogen, so far as discovered by analysis. Another, "with a foul smell," contained only one eighth of one per cent. of carbonic acid. There were "no combustible gases." In their investigation, they found only traces of ammonia, and often no sulphureted hydrogen. It is needless to multiply cases. It is not, of course, denied that sewer gases have been found so concentrated and foul as to produce suffocation; but very bad effects are well known often to follow the admission of such minute quantities into our houses that they can barely be perceived, much less suffocate. That it lowers the tone of health, and sometimes produces active disease in those who are subjected to it, is too well known to admit of a doubt. So far as this first effect occurs, lowering the tone of health, we can easily imagine it to be produced by *chemical* causes. Definite physiological results are known to follow the absorption into the system of definite chemical compounds. The effect of medicines and of poisons are illustrations too common to need more than a reference to them. The agent may work speedily, as in the case of active poisons, or slowly as in the case of cumulative ones. The effects may be gentle, as with certain tonics, or violent; and, as in arsenic poisoning, take a somewhat definite time, like a fever running its course; but in all poisoning by chemical means, the physiological effect is largely proportional to the amount of the chemical used, and the effects cease with the victim. Moreover, the results are reasonably uniform.

This is very unlike the effects believed to be caused by sewer gas, or other filth gases, where the results are by no means uniform, nor do they appear to be at all proportionate to the amount of the gas breathed, nor its degree of concentration. More than this, the results do not stop with the victim. Typhoid fever once started may extend, we know not to how many other victims, if the right conditions exist to carry it. And this brings us face to face with that mooted subject, the *Germ* theory of zymotic diseases, a theory now generally accepted by chemists, but strongly combated by some of the most eminent microscopists and physiologists.

That typhoid fever has been caused by the escape of gases from sewers and cesspools into houses, seems to me to be proven beyond a reasonable doubt. For illustration, — in the now famous town of Croydon, special cases are mentioned (9th Report Medical Officer of the Privy Council, 104) where the disease is alleged to have been distinctly traced to this cause. The gas was known to have been driven into the house; it "did not smell offensively, only a faint, sickly odor being recognized." In this case, the gas was driven into the house by a shower filling the conductors with water; other cases at the same time are believed to be traceable to the same source. The odor was generally not rank, "a faint odor alone being recog-

nized." I think it is generally conceded that typhoid, once started, may be propagated from patient to patient through the medium of the evacuations. Now, all this is unlike the operation of any known chemical compound, gaseous or otherwise. Again (from the same Report) the outbreak of cholera in the City of London Union Workhouse, in 1866, investigated by Mr. Radcliffe, was shown to have taken place, in all probability, from a sudden efflux of "sewer air from a drain containing choleraic evacuations," this efflux being caused, or at least favored, by a sudden change of atmospheric temperature and pressure. Here, again, the gas, or "sewer air," spoken of as the agent, is not necessarily a "gas of decay;" yet, if a gas at all, it must have been an organic gas, acting as a poison, but how unlike all actual chemical poison where the agent is a known chemical compound.

Again, decay of filth in the dark and away from free access of air is supposed to be productive of gases especially dangerous, more so than when decay goes on in the light and free air, and moreover that sewer gas is rendered less hurtful by a free circulation of air within the sewers. That this last is not due to mere dilution is shown by the deleterious character of the gas when diluted only after it enters the houses.

Considered purely as a chemical question, these facts, if facts, are entirely inexplicable. If the germ theory is accepted, a plausible explanation is more easy. It is possible to imagine a condition of things in decaying organic *gases* similar to that which occurs in decaying organic *infusions*. It is universally known that such infusions soon swarm with minute organisms; in fact, their almost universal occurrence in such connection gave these organisms the general name of "*infusoria*," and different forms are generated according to the different chemical characters of the infusion. The changing organic compounds in the fluid are doubtless the food by which these low organisms are nourished. Certain specific forms thrive best in certain definite infusions, and appear there when given proper temperature, and once started they increase and multiply as do other organisms. Now it is easy to imagine an analogous state of affairs in decaying organic gases. Moisture is always an element in these unwholesome gases of decay, and along with it are some gases that are organic, generated by the breaking up of the more complex molecules. Their quantity may be small compared with the whole volume of gas with which they are mixed, and yet sufficient to nourish floating organisms, just as a mere trace of solid matter, dissolved in much water, making a very weak infusion, is often nutritious enough to support its swarms of infusoria. If this be the case, it may possibly explain the anomaly that dilution of gas with air within the sewer renders it comparatively harmless, while it may be very poisonous if it is diluted only after it enters our houses. If the analogy is good, that floating organisms which may be the germs of disease feed on and multiply in the decaying organic gases of sewers, as infusoria feed on and multiply in infusions when the temperature and degree of concentration are favorable, then such floating organisms, after having been produced in the sewer and then admitted into the house, would not be destroyed by dilution of the gases in which they float; while, on the other hand, proper dilution in the sewer might by oxi-

dation or in other ways prevent their generation, or at least so impair the conditions that they cannot multiply in harmful numbers.

The belief that malaria is related in some way to the gases of decay, has already been referred to. That it is often so associated in moist air, is well enough known. The draining of swamps and giving the air access to the vegetable mud accumulated in such places, the clearing of land and consequent rapid decay of accumulated leaf-mold, have often been related to the existence or spread of malarial diseases. Even the decaying leaves of our shade trees in the streets are often accused of adding to the malaria of a region. In these cases the decay goes on in free air and light, and the gases are diluted to the last degree as soon as liberated from the generating mass. Yet, here too, we can understand how organic gases may be concentrated enough, before being poured forth into the atmosphere, to give the requisite nourishment to the organisms or "germs." Such decaying vegetable matter is very porous; it contains air as a sponge may water, and this air, permeating the decaying substance, cannot be otherwise than highly charged with the product of decay, ready to be driven out in several ways. Take rotten wood as an example. The measure of its porosity is seen in the difference of weight when wet and dry. A little experiment, tried for another purpose the present week, may be used as illustration. A few days ago, where some workmen were repairing the wooden pavement in one of the streets of our city, I picked up a few pieces of the half rotten wooden blocks. They were saturated with the water of the recent rains. Two pieces weighed, as they came wet from the pavement, respectively, 287 and 130½ grams. They were then left on the table in my study four days and then yesterday weighed again; they were not nearly dry, yet they weighed respectively only 154 and 54½ grams. That is, as thus dried, one will absorb 86 per cent., the other (and most decayed) 139 per cent., water, before saturation. It is easy to see how much foul air in a concentrated form a wooden pavement, half rotten, may hold, to be driven out by the first shower, or any other cause that disturbs the equilibrium of the atmosphere.

I did not intend to say so much of this germ-hypothesis, but have been led to it by looking at the chemical side of our inquiry. We are discussing the subject of better ventilating the sewers of our city. I have been trying to get light on this rather new problem, new at least with us; and the more studied, the more necessary seems to me such ventilation, even on purely theoretical grounds. If the chemical hypothesis of poisonous gases be the correct one, then, by perfect ventilation, we secure more speedy oxidation and get those ultimate gases which it is known do not produce the active diseases which we believe to be due to sewer gases. If, on the other hand, we accept the germ-hypothesis — that such diseases are caused by specific organisms — then by ventilation we may impair the conditions which produce such organisms or under which they multiply.

A NEW PROFESSION IN THE SERVICE OF HYGIENE.

SUGGESTIONS SUBMITTED TO THE ASSOCIATION AT THE MEETING IN BOSTON, OCTOBER 6, 1876.

By Professor E. N. HORSFORD,

Cambridge, Mass.

Do we not need a new profession? Is there not a field as yet unoccupied, notwithstanding the great numbers of specialists that have grown up in the division of professional labor to meet the wants of our advancing civilization? It is not a new artisan that is needed; nor is it exactly a new specialist.

There have come up with the application of science to the acts of practical life, more especially as connected with our domestic life, a great variety of luxuries, comforts, conveniences, necessities, which rest upon contrivances more or less complicated, and, as a general thing, but imperfectly understood, by the average occupants of the houses, and still less understood by the average servant. Let us glance at the various employments that are involved in the erection and arrangements of a well-appointed modern dwelling-house.

We have, besides the landscape gardener and the architect, the decorator, the carpenter, the stairmaker, the sash and blind maker, the glazier, the roofer, the mason, the plasterer, the plumber, the gas-fitter, the locksmith, the bell-hanger, the burglar-alarm man, the furnace and range man, the painter. After the several subordinates have completed their work, and the dwelling is turned over by the architect, and accepted, at first glance the occupation of the artisans seems to have been terminated. In reality that of some of them has only just begun. The plumber is established for life, as the next winter's frost will show. In his train will come the plasterer and decorator to restore the ceiling, flooded and discolored, if not thrown down, by the bursting of a forgotten pipe. The roof will leak, and the slate must be renewed. The ventilation will be found to be inadequate or imperfect. The fire-place will smoke, or the chimney refuse to draw when the wind is in a particular quarter. The warming will be partial and irregular. The fire in the furnace will burn fiercely, or go out altogether, or warm only the lee side of the house. The carbonic oxide will escape through the joints of the castings to poison the air of the house. The gas-jets will flicker or diminish. The friend will ring, or attempt it, and repeat the attempt, and leave because no one comes to the door. Ice will fill the eaves-trough, and the water from the melting snow will overflow upon the doorstep. The range will not bake. The boiler connected with the water-back will leak or become overheated. The waste-pipes will clog. The

closets will become obstructed, and will be offensive when clear. The water through the pump, or from a hydrant, will be objectionable, or fail. Mosquitos, cockroaches, ants, water-bugs, rats, mice, and moths will be regarded as necessary evils to housekeeping. The house will become the abode of colds, or the visiting place of typhoid or diphtheria, or malaria with its train of ills, — the evidences of imperfect draining, warming, and ventilation.

Is there relief from this formidable array of ills incidental to domestic life? Do they not point to the need of a new profession, akin to that of engineering, or to that of engineering and medicine united? Consider on what these ills rest. In part, they rest on faulty construction at the outset; but also, and perhaps more, on the fact that the house is a *human* habitation, with somewhat complex contrivances, not wholly clear in their modes of action to the comprehension of the average proprietor, and yet placed in the charge of less competent servants, — contrivances more or less perishable, however well constructed, and dependent for successful working on constant conditions, while the actual conditions of working are constantly varying. To find out what the difficulties are, and what should be done to remedy them, requires the presence and service of a scientific and practical mind, — a mind which in some sense is a repository of the experiences of gas and lead pipes, of furnaces and chimneys, of ventilation and drainage. The accumulated experiences would of themselves enable the possessor, if a man of proper training, to give most valuable counsel.

Such a repository would be the man who, having received a sound scientific and technical education in physics, mechanics, chemistry, hydraulics, and especially in practical hygiene, and such general higher education as would give him title to the respect and confidence awarded to culture, sets himself apart to be the "house physician," "the sanitarian," — the efficient and consulted brother of the "family physician." He would have his well-defined field of professional labor. It would be his duty to find out from symptoms what the real troubles are in the ill-working apparatus of the dwelling-house. Having found them out, he would make a sketch — a written prescription — for the changes to be made by the plumber, or mason, or gas-fitter, or other artisan; and this operative would carry out the work prescribed. The "house physician" would receive a small professional fee, corresponding, as an established rate, in amount, perhaps, with that of the family physician, for services requiring an equal amount of time. The fee need not be large. The profession is for life. As he wins confidence, and his experiences accumulate, his services will be in greater demand, and his counsel will be sought, and so his professional income be correspondingly increased. He will have his patrons (or his patients), who will call upon him with the freedom and confidence and frequency with which they call on the family physician.

Let us see how this would work. It would extinguish the guess-work of the average plumber. He would be employed to carry out prescribed work, and be paid for *time* work, once for all; and not for doing the same work over and over, each time in a different way, and always more or less

imperfectly, because of the ignorance of the workman, and because much of his work in a difficult case is but guess-work at the best. What is true of the plumber would be true, to a larger or lesser extent, in cases of real difficulty, with most of the other artisans. Then we should have relief from annoyance *promptly*, and not go on vexed in temper as well as in our comfort and convenience, because the artisan in former cases had tried, been paid, and given no valuable return. With perfected drainage, warmth, light, water-service, and ventilation, would come improved health to the household, increased cheerfulness to the domestic service; and while augmenting the comfort and refinement of our homes, we should increase our days of capacity for effective labor, lessen our physician's bills, and, as a whole, the class of bills connected with house alteration and repairs which grow out of imperfect, because ignorant, work. Finally, such an established professional service would improve the plans and details of dwellings to be hereafter constructed, because it would provide for the gathering and preservation and intelligent reading of the lessons of household experiences.

It is scarcely to be expected that these suggestions will be acted upon at once; but it is not too much to say, that if a considerable number of the well-educated young men of our cities and towns would devote themselves first to thorough preparation, and then to the sphere of service here indicated, they would enter upon a most useful, honorable, and, in the end, lucrative field of labor, — more certain in Massachusetts to bring a thoroughly satisfactory return, in the way of position and income, than the average that awaits the lawyers, physicians, and clergymen of the Commonwealth.

THE POPULARIZATION OF SANITARY SCIENCE IN SCHOOLS.

By Professor E. W. CLAYPOLE,
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A PAPER PRESENTED AT THE ANNUAL MEETING OF THE ASSOCIATION AT BALTIMORE.

By the title of this paper I mean to express the diffusion among the people of all that can come under the head of Sanitary Science ; all that relates to the prevention of sickness and death, not only in communities but in individuals, such as guidance in eating and drinking, cleanliness and drainage, supply of air, light, sunshine, and water ; all that relates to the prevention of epidemic and epizoötic diseases, — the removal of nuisances, — the control of cemeteries, manufactories, slaughter-houses, and other places producing such nuisances. Further, I include all that relates to the hygiene of the mind, such as the regulation of study, both in nature and amount, the building and discipline of schools, asylums, jails, refuges, and reformatories, with all that tends to the prevention of mental disease, whether in the form of insanity or crime. All these I claim as fairly lying more or less directly within the domain of sanitary science, while, on the other hand, the great department of sanitary science, or the noble art of healing, includes whatever relates to the *cure* of diseases of every kind, — mental and bodily, physical and moral, that prevail in the community.

Since "prevention is better than cure" we must logically set the sanitary before the medical art ; but it is chiefly, if not altogether, through the labors of medical men that sanitary science and art have reached the importance and the certainty they now enjoy, with the promise of yet higher dignity and usefulness in the near future. The importance of sanitary science to every civilized community may be measured not merely by a philanthropic but by an economic standard. Though founded by philanthropists to alleviate human suffering, it has long commended itself to economists by confirming the opinion that disease and crime are costly factors in a nation's life, which it is not only humane, but actually profitable to eliminate ; and, in addition to this, it has almost awakened the belief that such elimination is possible, and has shown the steps by which it may be accomplished.

Next in importance to the discovery of such truth as that on which sanitary science is based we notice, —

(1.) The diffusion of that truth through the community, and

(2.) The conversion of the community to belief and to corresponding action.

Side by side with these stand two difficulties which must enter largely into our consideration of the subject : —

(*a*.) The popular ignorance of the facts, physiological and others, on which sanitary science is founded,

(*b.*) The inertia or bias in the wrong direction resulting from long-continued custom.

(*a.*) *Popular ignorance of the facts on which sanitary science is founded.* — It may not be a new, but it is a very apt figure to say that every man is an engineer, in charge of an engine of very intricate construction, and very difficult to understand. This engine he is compelled to drive every day of his life, and it would be wise in a man so situated to make himself in some degree familiar with the construction and details of his engine, so far as to know the functions of the various parts, their modes of action and the accidents to which they are peculiarly liable, together with the simplest remedies applicable in case of emergency: surely every man, before he undertakes to drive for seventy years or more the marvelously complicated mechanism of his own body, ought to possess some knowledge of its construction and action lest he unwittingly ruin it. It has been asserted that the less a man knows about his stomach, the more likely his stomach is to work well, and that the perfection of its action is attained when a man does not know that he has a stomach at all. I once heard a lecturer advise his audience to do without a constitution, as he had done for forty-five years, and so save the anxiety and trouble of taking care of it. For a bit of claptrap on the platform and to raise a laugh this was all very good, but logically it was not to the point. A man who has been so educated concerning his anatomy that he spends a great part of his time and thought in taking care of his stomach and lungs has never had any physiological education. The first effect of a true physiological education would be the direct opposite of this. Without making "every man his own doctor and giving him a fool for a patient," it would instil into every child such knowledge as would enable him to avoid most causes of disease, and to maintain his vital engine, that is, himself, in good working condition, accident excepted, to a good old age. This is the high requirement of modern sanitary science, and to the ultimate attainment of such a condition of perfect natural health the efforts of sanitary reformers are now earnestly directed.

In this great work of Sanitary Reform, the most important step, after the discovery of truth, is to provide for its diffusion. And for the diffusion of knowledge the school is, or ought to be, the best possible engine. The next generation can be reached and elevated in sanitary condition by education, more thoroughly than the present by legislation. I mean an education that rouses attention by bringing a pupil into close contact with the things and not with the book, — which awakens a desire to know and not merely to learn, — and makes what is studied so familiar to the young mind that no labored effort is necessary to retain it. It becomes a part of the mental furniture, not an addition to the already overcrowded mental lumber-room. Herbert Spencer's views on this subject are very suggestive and may not be without value.[1]

1 "Knowledge which subserves direct self-preservation by preventing loss of health is of primary importance. We do not contend that possession of such knowledge would by any means wholly remedy the evil. For it is clear that in our present phase of civilization, men's necessities often compel them to transgress. And it is further clear that even

"Right knowledge rightly impressed." This phrase exactly expresses the great need in the teaching of physiology in our schools, colleges, and universities. And before true sanitary knowledge can be popularized in the nation through the agency of our educational system, that system must be reformed, if not in part revolutionized. Physiology, and the other sciences on which sanitary living is based, must be taught as deeply-important branches of learning, not as mere pieces of routine. They must be taught so as to convince a student that life and death, health and disease, are to a great extent in his own hands: that to keep himself in good working order, in good condition and spirits, is not only possible, but right, and a duty to himself and the community. In order to accomplish this desirable end it is necessary that every institution of learning should be occupied and inspired by teachers who *understand* the various branches required for the successful teaching of Sanitary Science, and that they be able to obtain the requisite books and other material. Of these the first is by far the more important. The man, if competent, can more or less perfectly supply the machinery; but no outfit, however costly, can produce or supply the place of the living teacher. I do not mean by this that any large addition should be made to the teaching force, but that the work done should be done in a more thorough and practical manner; that those who teach physiology should be qualified to teach it broadly and connectedly; that they should be men and women in whose hands a skeleton is something more than a bag of "dry bones," — such as the prophet saw; men and women before whom the bony framework becomes clad with flesh and almost instinct with life; not, perhaps, professional anatomists, but, what is more to the purpose, anatomical students, growing year by year more perfect; not mere questioning machines, grinding out printed questions from the end of the book, pumping out set answers from their pupils, and shielding their own ignorance behind the plea of excluding all "that is not in the lesson." What we want is teachers in whose hands a bone, a piece of muscle or fat, a pair of lungs, a brain, or any other organ or part of the animal frame, becomes the topic of a useful and interesting anatomical lesson on structure, from which in orderly sequence flow the functional lessons of physiology, and show the further and wider inferences of Sanitary Science: teachers whose knowledge is not limited to the lesson or the text-book in hand, who are not content to be a few pages in advance of their students; who do not discountenance questions from their classes; teachers who have at command other branches of science as aids to illustrate the

in the absence of such compulsion their inclination would frequently lead them, in spite of their knowledge, to sacrifice future good to present gratification. But we do contend that the *right knowledge* impressed in the *right way* would effect much, and we further contend that as the laws of health must be recognized before they can be fully conformed to, the imparting of such knowledge must precede a more rational living — come when that may. We infer that as vigorous health and its accompanying high spirits are larger elements of happiness than any other things whatever, the teaching how to maintain them is a teaching that yields in moment to no other whatever. And therefore we assert that such a course of physiology as is needful for the comprehension of its general truths and their bearings on daily conduct is an all-essential part of a rational education."

subject in hand, — mechanics, to explain the action of the bones and muscles; chemistry, to throw light on the processes of digestion, absorption, respiration, etc.; optics and acoustics, for elucidating the functions of the eye and the ear; teachers whose pupils are as free to question as to be questioned. Such teachers, even with small material but with freedom to teach as they see fit, would soon work a reform in the mechanical routine now only too common, and infuse new life into their classes by the contagion of their own enthusiasm.

Changes such as the existence of such teachers would imply cannot be made at once or quickly. To be lasting they must be slow. The first change that should be made is at the top of the Educational System. The future teachers of the country must have better opportunities of fitting themselves for their work. Our universities and colleges need reformation in this respect. Better and more practical methods — if adopted there — would gradually filter down through the strata. These institutions should become schools for thought and work. They should take the young men and women and bring them into actual contact with the objects of their study, and not keep the veil of a text-book forever before their eyes. They should encourage study, not mere acquisition. They should guide rather than drive, educate rather than instruct, incite their pupils to follow up paths of investigation for themselves rather than compel them all to tread the same beaten track; in fine, they should be foci of independent thought and action. They should enable their students to learn as they ought to teach, instead of requiring from them the schoolboy task of daily recitation. For this purpose a physiological laboratory should be accessible to all students of the subject, and the work of the laboratory should be held of greater importance than that of the class-room. It is from the former rather than from the latter, that they will draw the inspiration that will send them forth to their own work to become centers of sanitary influence and light in the common schools of the nation.

Another desirable step is the establishment of locally central schools, not permanently maintained, but kept in operation for a certain time every year. To these, men and women actually engaged in teaching, could go periodically and prosecute some special study in order to qualify themselves to teach it. Such schools must not be expensive or distant; nor would they require large and costly buildings. Indeed, they might be carried on without any permanent or fixed home at all; rooms for the purpose could be obtained without any very great outlay. The one essential point would be the employment of teachers — of whose competency there would be no doubt — not to teach, but to superintend the work of the students. Mere knowledge would not be enough. There must be also an enthusiasm for the work and a willingness to help the workers, which rank above the highest attainments in those who wish to be successful in teaching. Experiments have been made in this direction within the last few years. One of these was the Anderson School of Natural History in Penikese Island, begun by the late Professor Agassiz. The results of this short-lived laboratory of Natural Science were, educationally, exceedingly gratifying. The other experiment

of the kind was the Summer Geological Camp School, conducted by Professor Shaler, of the Kentucky Geological Survey, at Cumberland Gap.[1] Temporary or periodical schools of this kind under good management would do more to spread true knowledge and methods of teaching than all the hand-books, text-books, and manuals. Anatomy and physiology should stand prominent among the subjects taught, and a race of teachers would gradually arise capable of understanding and of communicating the facts of Sanitary Science to their pupils. One more requisite I must mention, which depends rather on the managers of the school than on the teachers. It is to offer a teacher such as I have described a sufficient inducement to abide in his profession. He may not do in all points as they think he should. If he is really capable, he certainly will not; he will find fault with many time-honored practices. If a physiologist, he will condemn many of the arrangements of the school as injurious to health; he will be constantly needing some little improvement or alteration; in short, he will be a reformer. It is the duty of managers to support such a man to the utmost of their power.

Nor is the objection justified that such a teacher is too expensive. His charges will be made at as low a cost as possible, and will be largely refunded in the improved health of the children. The largest contributor to the School Fund where sanitary laws are carried out will probably be the doctor. He, perhaps, may lose somewhat more by the change than he would gain; but the community is no loser: it is one of those cases where the greater outlay is the best economy. Stinting the salaries of good teachers, and especially denying them the means of improving the bodily and mental hygiene of their scholars, is "saving at the spigot to waste at the bung-hole." Cheap teaching is generally bad, and bad teaching is never cheap. I would strongly recommend that some part of the time now devoted at institutes to showing off classes and discussing everlasting grammar and interminable arithmetic be set apart for the purpose of aiding teachers in gaining a practical acquaintance with the foundations of Sanitary Science, — with anatomy, physiology, chemistry, and kindred subjects.

Education and refinement, like water, flow downward. Success in educating and refining the lower strata of society has never been gained by attempting to lift them out of their original position, but by the gradual filtering down of educating and refining influences from the educated and refined classes. In order, therefore, to diffuse Sanitary Science widely

[1] Since writing this I have learned that similar schools were attempted at Cleveland, and at Peoria during the past summer. The results I have not learned, nor do I know if physiology and anatomy formed any part of the course. The Kirtland Summer School of Natural History was inaugurated July 6, 1875, at Cleveland, O. The session extended through five weeks. Instruction was given in botany and entomology by Professor Theodore Comstock. Dr. William Brooks undertook the teaching of invertebrate zoölogy. Professor Tuttle, of Columbus, that of microscopy; and a short course of lectures on geology was given by Dr. J. S Newberry. *The work was all done in the laboratory, and in the field, — text-books being wholly discarded.* The school consisted of twenty members, of whom thirteen were ladies. The fees amounted to ten dollars, the expenses being met by subscriptions, and the instructors receiving but slight compensation by a division of the small balance in hand.

through the nation, we need first improve our physiological teaching and our unsanitary modes of life in the higher institutions of learning; next let us provide means of physiological and sanitary instruction for teachers whose age or means or time will not allow them to take a college or university course; thirdly, let us utilize as far as possible for the same purpose all existing organizations, such as Teachers' Institutes; and fourthly, let those who control our schools, in town and country, see to it that by no spirit of false economy or other unworthy motive they obstruct the steady improvement of teachers and scholars in the "Art and Practice of Healthy Living."

"*The inertia or bias which the sanitary reformer constantly encounters arising from long-continued custom.*" Those who have had no experience in education, especially in the way of sanitary improvement, may not at first catch the exact meaning I have tried to embody in this expression. But all who have attempted it, even on a small scale, are perfectly well aware of the dead resistance based on nothing but prejudice, habit, and ignorance, against which they are constantly, and often vainly, compelled to struggle. To no changes, with perhaps one exception, is the opposition so bitter and so blind as to sanitary changes. To follow out this subject fully would require a discussion of several interesting questions which suggest themselves at this point. Among them may be mentioned the following: —

What is the reflex influence of sanitary legislation in forming public opinion and removing prejudice? What is the power of the press in the same direction? Is there not a great necessity for strong and habitual self-control, combined with knowledge, to enable men to keep themselves in good health amid the temptations to indulgence of the present day?

Each of these questions would require a whole paper for its consideration, and they must, therefore, be now left untouched. So far as this inertia in the wrong direction, this opposing force to sanitary progress, exists in schools and colleges, it is logically a part of my subject, and so far I will follow it out.[1]

[1] A few illustrations will show how far the charge is well founded that our colleges and schools contribute to increase this difficulty by their own neglect of sanitary laws. Read the report lately issued concerning the condition of the public schools in some of the large cities of America. Physiologists say, that "for practical purposes the limits of air-space in dwelling-houses, hospitals, schools, etc., vary from 300 to 4,000 cubic feet, and no deviation should be allowed on account of children, either in a family or in a school-room.

"If 300 cubic feet only are allowed, the air must be changed at least every twenty minutes. To neutralize the deleterious properties of respired air and to replenish it, every person requires 2,000 feet of fresh air hourly." * And yet, in the face of this sanitary law, which has been published so often that ignorance of it has become a crime in school managers and school-teachers, we read the following report of the condition of various rooms in the public schools of Brooklyn: —

70 children in 7,560 feet of space, 108 c. f. to each.
32 children in 2,250 feet of space, 70 c. f. to each.
126 children in 6,300 feet of space, 50 c. f. to each.
67 children in 2,000 feet of space, 30 c. f. to each.
56 children in 1,680 feet of space, 27 c. f. to each.
66 children in 1,584 feet of space, 24 c. f. to each.

* The *Sanitarian*, January, 1875.

This is the sanitary education which thousands of children are receiving in the city of Brooklyn. This is the load that has to be moved before true sanitary education can begin. Lunatics, maintained at public cost, receive better treatment. Criminals, confined in jails for the public good, live in healthier conditions. There are numerous other examples that may be adduced when unsanitary conditions, quite as insidious if rather less openly repulsive, prevail. Our text-books on physiology usually point out the ill effects of foul air upon the health. Yet who that has any experience of American schools and colleges has not heard classes "reciting" these wholesome sanitary truths in rooms where the atmosphere was utterly unfit for human lungs to breathe? Text-books on physiology sometimes warn girls against the evils of tight dressing. Yet these girls often "say their lesson" to a teacher whose own figure shows too plainly that this sanitary law has no influence whatever over her own mode of dress. Text-books occasionally point out the evils of certain kinds of food and cookery. Yet how few of our teachers, by their tables and their diet, show that with them this knowledge is turned to daily use, and that to live and to be healthy is more than to eat! Text-books describe the eye, its delicate structure, and marvelous functions. Yet how many students and teachers, by reckless use of this organ, in bad light and at late hours, show that they make no use of the book-lesson they have learned. The danger of overtasking the brain by excessive or ill-arranged study is often forcibly pointed out. Yet do not the general nervous weakness and the continual break-downs of teachers and students in the midst of a course of study prove how little they regard the laws of physiology and of physicians? Of such we may say with one of old, — "Whatsoever they bid you observe, that observe and do; but do ye not after their works, for they *say* and *do* not."

Sanitary teachers will in time produce sanitary schools. But they must be men and women with whom to know is to do, and who teach their scholars physiology and hygiene more by their own sanitary lives and actions than by any amount of work required of them in class. They should be men and women of good physical health, with senses trained or accustomed to know and to choose sanitary conditions of life and intolerant of the unsanitary. Nor does the difficulty end here. If we follow these scholars away from school to their homes, we find them too often among conditions in life to which the adjective "unsanitary" would be a mild term to apply. The school may be all that can be wished for healthfulness. There they

This is all nearly as bad as it can be, but worse is to come. In reporting on the temperature the inspector says: —

"The thermometer ranged from 58° to 82°.

"Temperature in range of seats next to stove was 90°; in those most remote, 66°.

"Thermometer ranged from 50° to 95°.

"The hot air from the register raised the thermometer to 150°, and within three feet of this sat a pupil. I cannot describe the condition of the atmosphere; the children had hardly sufficient energy to leave their places."

Again, he says: —

"Temperature in some rooms 50°, in others, 75°. Vaults full and offensive; apartments disgusting; urinals are wooden troughs saturated with filth, without means of flushing."

may breathe fresh, cool air, but when they leave they enter the fetid atmosphere of small, crowded, overheated rooms. Let all the influences of school be on the right side for the health of the children, yet their dress, their food and all more important elements of their lives are controlled from a home where the influence of the teacher is little felt, and by causes over most of which they have no power.

The foregoing may suffice to explain what I mean by "the inertia in the wrong direction arising from long-continued habits." Against this the voice of the Sanitary Reformer, unaided, is powerless. At every step he is met by objections, some valid and rational, others, idle and senseless. But valid or idle, they stand in his way like an immovable load. So far as they arise from ignorance we may hope to remove them by the combined agencies of Education and of Time; but against the opposition of Habit and Prejudice, the action of these is slow and almost hopeless, and some more rapid and powerful agents must be invoked to the aid of Sanitary Reform.

FLORIDA AS A HEALTH-RESORT.

By F. D. LENTE, M. D.,
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ABSTRACT OF A PAPER READ AT THE ANNUAL MEETING IN BOSTON, OCTOBER 6, 1876.

For years the question, *Where shall I spend the winter?* of a phthisical or phthisically-inclined patient, has been an embarrassing one to the physician. Winter resorts, some of them entirely dissimilar in the characteristics of their climate, have risen or fallen in the estimation of the public, and, to some extent, among medical men, according to the prevalence or decline of a theory, or apparently even a fashion; and we are still, to a great extent, at sea as to what is the most favorable location for an invalid in winter or spring, or even whether any change is desirable.

The discussion of the broad question of climate, in its various aspects and bearings, has always been a perplexing one. It is especially so when we, as physicians, come to consider it in its relations to any particular individual, or even any particular disease. To analyze the mass of information with which we are confronted, to scrutinize the various conflicting statements of equally reliable observers, and to deduce anything like a definite and satisfactory conclusion, with regard to any particular locality or country, is a matter of no small difficulty. To this sort of investigation the writer has addressed himself for the past two years, in the case of Florida; and indeed, for the most part, only to a small portion of the peninsula, that which is most accessible to invalids. For, until proper facilities for easy travel and proper accommodation are provided for those larger portions lying along the Indian River and along the Gulf coast, south of Tampa, which are supposed to present attractions superior to the more northern portions, their relative merits may profitably be left out of the question. The great bulk of tourists and invalids have heretofore distributed themselves along the St. John's River and at St. Augustine. A few go into the pine-regions of the interior to get away from the river. But, go where one will in Florida, it is difficult, owing to the peculiar conformation of the country, to escape the influence of considerable bodies of water. With reference to Florida, "almost without a metaphor," says "Chambers's Encyclopædia," "it may be described as amphibious." This, however, so far from being a disadvantage, constitutes, to a certain extent, its charm, and will, in the future, constitute a great source of its wealth — these bodies of water being, for the most part, clear streams and crystal lakes.

As regards the *variability* of the temperature so often adverted to as a very serious defect in a sanitary point of view, it is conceded that, as in almost all climates, under almost any parallel of latitude, changes, not in-

frequent, and sometimes very great, do occur, and are occasionally felt to be injurious by a few invalids afflicted by certain diseases; but that, as a very general rule, they are not felt to be injurious in Florida, as they are in more northern latitudes; and it is claimed that patients, and especially pulmonary patients, do much better in a climate where a period of quite warm, and sometimes of oppressively warm weather, is succeeded by quite a cool temperature, necessitating fires for a few days, during the morning and evening; and the most debilitated patients usually hail those changes with great satisfaction. It is claimed that this feature renders the climate of Florida more beneficial, and less likely to induce debility, as the end of the season approaches, than the uniformly high and unvarying temperature of more tropical climes. At the same time, it is conceded that the latter are more advisable for a certain class of diseases, as neuralgia, possibly rheumatism, and nasal catarrh.

The statistics of Forry show that large bodies of water modify climate favorably, and that the ratio of pulmonary disease increases with the increase of the mean annual ranges of temperature, as regards the seasons, rather than the prevalence of sudden and diurnal vicissitudes; and that the injurious effects of moisture, even in cold climates, are more than counterbalanced by the modification of the temperature of the air, induced by the warmth of the water; while, in warm climates, in winter, the moisture has a positively beneficial effect in limiting the diurnal vicissitudes. It is also contended that the traditional idea that, in cases of softening of pneumonic consolidation or tubercular deposit, the patient runs down more rapidly in a southern climate than in a northern home, is incorrect according to his observation. It is true that they are often sent down in such a helpless condition that they never rally from the fatigue, and not unfrequently die on the journey; and this may partially account for this idea. However, these cases, though they seldom recover, unless the cavity be restricted by well-defined limits, and not very large, often secure a longer lease of life, through the influence of a constant residence in the open air, of exemption from the cares of home and business, and other injurious influences. In a more tropical region, as in the Bahamas and West Indies, where the warmth and moisture are continuous, or very nearly so, throughout the entire winter, it is very likely that a fatal issue may be hastened in these unpromising cases.

The habit, too common with physicians, of sending patients with extensive and advanced disease of one or even both lungs, to Florida, is deprecated, as no permanent, and frequently no temporary benefit, is secured, and thus the reputation of the climate suffers. From an examination of the statistics of the U. S. Army Medical Department, and from other reliable sources, it is demonstrated that Florida is subject, during both winter and summer, to fewer fatal diseases than any other portion of the country; that is, that the number of deaths among the soldiers was less than in other divisions of the army serving in other portions of the country. The pernicious fevers, so common in other Southern States, are seldom seen here; scarlet fever is rare, and diphtheria almost unknown even in the cities. Those who suffer most from fevers in the summer, and exhibit the marks of

disease in their appearance, are the natives mostly, and the classes who disregard all sanitary and hygienic rules, and are subjected to influences which, in any climate, would produce similar results. They live in houses, if they can be called such, not affording sufficient protection from the cold of winter, which is at times pretty severe, and more injurious because comparatively rare; they are insufficiently clothed, — good, warm, woolen clothing being very necessary here; they drink surface water from shallow wells, and they eat the inevitable "hog and hominy," the latter sometimes half cooked, and mixed, in large proportion, with the semi-liquid grease of the fattest pork they can find; then they consume quantities of soda in their bread, making their stomach a veritable soap-factory. They thus become victims, sooner or later, of constantly recurring "biliousness" and "dyspepsy," for which "liver pills" and "bitters" are taken with temporary relief. What wonder, then, that the traveler sees sallow and haggard countenances, and premature old age, and bloated bellies among the "swamps of Florida," and exclaims against the pestilential "malaria."

"*Who should go to Florida?*" — All persons would find in the balmy air of Florida a happy relief from the sharp and chilling blasts of the lagging spring of the Northern States, and that a great variety of diseases, besides pulmonary, are greatly benefited; especially spinal diseases, the subject of "wear and tear" of body and mind, nervous ailments, rheumatism, neuralgia, the incipient stage of Bright's disease, old age.

"*When shall one go to Florida?*" — Those who have hereditary tendency to tuberculosis, and have been threatened with pulmonary disease, cannot go too soon after the first of December, and occasionally they need to go earlier, in order to escape those complications so liable to occur in our Northern States, — pneumonia, bronchitis, pleurisy, etc., and so dangerous in these subjects. Those whose circumstances will not allow them to remain away from home but a limited period, had better defer their visit until the middle of February, and remain until the middle of May. It is a mistake to suppose that it is either dangerous or uncomfortable to remain in Florida in April, or even in May. The sun becomes very hot, it is true, and there is need to keep out of it during the hottest portion of the day, and to use a straw hat and sun-umbrella at all times, that is, in the case of invalids. But the temperature in the shade is not oppressive, and is generally modified by breezes which are decidedly tempered by the sea, even far inland. A temperature of 90° to 95°, in the shade, has been found to be not particularly uncomfortable by persons from the North sojourning here in summer. As regards the liability to *malaria*, a good deal depends on the locality, as it does at the North. In this village the danger is very slight in April and May, and there is but little during any portion of the year. There are northern men living along the river who have raised a family of children, who look as free from the evidences of malaria as those in our northern towns; some have never had fever of any kind in their families, and they have lived here the entire year.

"*How shall one get to Florida?*" — Under this head, the sea voyage is decidedly recommended. Coughs are almost always allayed by the trip,

and the health improved. The mixed journey, by the Old Dominion Line, whose ships and management cannot be excelled, is to be preferred by those who dread the whole trip by sea. Some directions are given for preventing or mitigating sea-sickness. Take *bromide of potassium*, in scruple or half drachm doses, three times a day for three days before embarking, and continue during the first day of the voyage. The use of "induced" electricity when the symptoms commence; the wearing of Jobard's belt about the waist as tightly as can conveniently be borne, has prevented it in many obstinate cases. It can be had at G. Tiemann's, 67 Chatham Street.

"*How shall one live in Florida?*" — It is advised, as a sine qua non, that such a hotel or boarding house shall be chosen as will furnish *good* and *well-cooked* food, which Florida is now prepared to furnish at reasonable rates at almost all points. To economize in this respect is to run the risk of defeating the whole object of a visit, fraught generally with considerable expense and sacrifice. Secure a sunny exposure if possible, and, as a general rule, above the ground floor. As regards apparel, one should take his winter under-clothes, a thick overcoat, and a light one, and clothes suitable for our late northern autumn. It is seldom that thin clothes are needed, or, in the case of invalids, safe. Avoid, by all means, the prevalent error of rushing about from place to place; and, if once settled where improvement is reasonably progressive, stay there. Don't exhibit the folly of changing because friends happen to be somewhere else, or because the place is not sufficiently gay, or for equally trivial reasons, which sway the mass of invalids in Florida. Seek always to find some occupation. Idleness and ennui are dangerous. "Brooding kills." The visitor, if he will look around him a little, and put forth some energy, can always find something to interest him. Be in the open air as much as possible; but as the spring approaches, don't expose yourself to the direct rays of the sun too much without an umbrella. Fever *may* be induced in this way in a person unaccustomed to a southern sun. Don't bring a chest full of medicines, with directions from your physician, to meet all possible contingencies of a whole winter, and don't seek to treat your complaints by correspondence with your physician a thousand miles away, and who knows little or nothing about the requirements of the climate. This is such sheer folly that it is a wonder that any reputable physician will advise it. Avoid the error of supposing that the climate alone will cure. It may and does, but as a general rule the patients require medical advice, and medical treatment, for the various complications of their complaints, here as elsewhere; indigestion, diarrhœa, profuse sweating (in the severe cases), cough, fever, restlessness, insomnia, may not be controlled entirely by the climate, though the remedies, which fail in the inclement weather of the North may succeed here.

ANNUAL REPORT OF THE TREASURER.

AMERICAN PUBLIC HEALTH ASSOCIATION.

BOSTON, *October* 4, 1876.

The receipts of the Treasurer, from the date of his election, in November, 1875, to the present time, have been as follows, namely, —

Membership dues pertaining to the year 1873–4	$25.00
Membership dues pertaining to the year 1874–5	90.00
Membership dues pertaining to the year 1875–6	490.00
Membership dues pertaining to the year 1876–7	25.00
Total receipts	$630.00

The Treasurer's disbursements have been $26.00, vouchers for which are herewith submitted.

Balance in the treasury, $604.00, of which amount $25.00 will be required to purchase five copies of Vol. I. of the Association's papers, still due to members who have recently paid their membership fees for the year 1873–4. Ninety dollars, membership fees of 1874–5, are due to the late Treasurer, Dr. J. H. Rauch, on account of publication fund for that year. Twenty-five dollars, membership dues for the year 1876–7, must be transferred to the Treasurer elected at this annual meeting.

The Treasurer thus holds $464.00, which he considers that he is entitled to apply toward the discharge of his personal obligation to Messrs. Hurd and Houghton on account of the manufacture and delivery to the Association of 450 copies of Vol. II. of its Papers and Proceedings, — constituting its Transactions for two years, inclusive of the annual meetings at Philadelphia and Baltimore.

The contract which was authorized by the Executive Committee, at its meeting of March 2d, calls for the payment of $750 by the Treasurer on the completion of the volume.

The proportion of members paying dues has steadily declined since 1873. Of members on the roll, about two thirds paid dues during the first two years, less than one half paid during the third year, and, for the year just closing, less than one third have paid membership dues. Respectfully submitted,

J. FOSTER JENKINS,
Treasurer, American Public Health Association.

ABSTRACTS OF THE ADDRESSES, MINUTES, AND SECRETARY'S REPORT, AT THE FOURTH ANNUAL MEETING, BOSTON, 1876.

ADDRESS OF WELCOME

By WILLIAM RIPLEY NICHOLS, M. D., BOSTON,
Professor in Massachusetts School of Technology.

It gives me great pleasure, gentlemen, to bid you welcome to our city. I bid you welcome in behalf of those of us, who, from the nature of our professions, are especially interested in sanitary matters. We have looked forward to your coming among us with anticipations destined no doubt to be more than realized.

I bid you welcome also in behalf of the Institute of Technology, who have been glad to offer you the shelter of this roof and thus aid somewhat, as they hope, in making your meeting in our city a pleasant one. I trust that one result of your present gathering will be to awaken among *us* a better appreciation of the very essential aid which sanitary science derives from the coöperation of the professions for which most of our students are educating, and of the duty which these professions (especially those of engineering and architecture) owe to public health.

Although with no formally delegated authority, I am sure that I venture nothing in greeting you cordially, also, in the name of our citizens at large. I can assure you that, while the number of those who may find themselves able to attend the daily sessions is comparatively small, the interest taken in the subjects you will discuss is very great. Your meeting comes at an opportune time. We are deliberating about the establishment of a series of parks on a scale of considerable magnitude. The condition of the present water-supply and of the sources which may be made sooner or later available for our use, has been a topic of no small general concern, and at present the highly important question of the sewerage of the city and of the disposal of our sewage matter, awakens discussion and interest not among specialists only, but among all of our citizens.

We all welcome you heartily. You do not come as strangers among strangers but as friends among friends. We welcome you, in one sense, selfishly, for the benefit will be to us; but we trust you will carry away with you such impressions of us and ours that we may look forward at no distant year, to a renewal of the associations here formed.

I could have wished that another had been chosen to offer to you our greeting. The care of the public health must always be the peculiar province of the medical profession, and I am, in a sense, only a layman. And yet the history of the progress of sanitary science shows that to laymen, also, do we owe much of the advance which has been made ; and in originating and in executing there is work for all. The work is one of interest in common and we are all laborers together.

ABSTRACT OF INTRODUCTORY ADDRESS

By EDWIN M. SNOW, M. D.,
President of the Association.

The President of the Association, Dr. E. M. Snow, of Rhode Island, presented an informal address in which he welcomed the members to the Fourth Annual Meeting of the Association, and congratulated them that notwithstanding the numerous conventions and meetings of the centennial year, so many true friends were present to discuss the important problems of sanitary science. He also congratulated those present upon the feast of valuable and interesting papers presented in the programme of the meeting. He then said : "The present condition and prospects of sanitary science in this country, and throughout the civilized world, were also matters of congratulation, and especially so in view of the greatly increased interest in the subject at present, as compared with the past. The progress of sanitary science was not shown so much in the amount of positive knowledge gained, the definite principles established, or in the practical application of existing knowledge, as in the creation of organized Boards of Health, and especially of State Boards of Health for the purpose of investigation." Reference was made to "the serious vital defects in the Boards of Health in our country until within a very recent period, which, though clothed in many cases with despotic powers, were only *ex officio* Boards of Health, no member of which was ever elected with the slightest reference to his knowledge of sanitary science, or to his qualifications for the duties of his office." Reference was also made to the "Quarantine and Sanitary Convention," which was practically rendered useless and destroyed by the influx of *ex officio* Boards of Health composed of politicians and others entirely ignorant of sanitary science.

Dr. Snow continued : "It is, then, a matter of congratulation that this is all changed, and that now the most of our cities and some of our States have Boards of Health qualified for their duties, and especially for the most important portion of their duties, — the organized and systematic investigation of the numerous causes of disease and death that exist in every community, in every State. The State of Massachusetts was especially to be congratulated, where the State Board of Health began its existence with a wise plan of organization, and with the personal assistance and counsel of gentlemen of long experience in sanitary knowledge, and eminent for scien-

tific and professional attainments. The result was, that, from the beginning the Board of Health in that State had merited and received the confidence of the whole community, and its reports were already reckoned among the standard literature upon the subject of Hygiene, rivaling in importance and value the most valuable sanitary reports in England, and other countries."

Especial reference was made to the valuable contributions to sanitary knowledge, from the investigation of the causes of consumption, by Dr. Bowditch, the chairman of the State Board of Health of Massachusetts, and to the investigations and action of that board which have been crowned with success, in relation to slaughter-houses; and, also, to its most thorough, scientific, and practical reports upon the pollution of rivers and other subjects. The eminently valuable papers of Professor Kedzie, Dr. Baker, and others, in the reports of the State Board of Health of Michigan, were also noticed. "But," continued Dr. Snow, "the evidences of progress in sanitary science, already noticed are, in fact, only the preparations for the great work yet to be done; and when we look at the field of sanitary science as it exists to-day, and see how little actual knowledge we possess in relation to the causes of disease, we find little reason for exultation. An absolutely complete and correct registration of deaths is found only in extremely limited portions of our country, hardly beyond the limits of half a dozen cities, and the registration of diseases is almost unknown. And yet such a registration is the first foundation of all intelligent sanitary work, and absolutely necessary to all correct sanitary investigation. Notwithstanding, then, the truth is well established and evident to all, that a very large percentage of the disease and mortality that exist in every community is due to causes that might be removed, we have hardly begun the work of removal, or even the necessary preparation and investigation for such work."

Dr. Snow further referred to the great want of positive knowledge with reference to the actual causes of disease, as illustrated in the voluminous and entirely unsatisfactory discussions in relation to Asiatic cholera, typhoid fever, scarlatina, and other prominent diseases.

He also commented upon the glaring defects in the practical application of the knowledge we do possess for the prevention of disease, as illustrated by the recent terrible prevalence of, and mortality from, small-pox in various places, in this and in other countries, notwithstanding our knowledge and possession of a preventive perfectly certain in its effects and simple in its application.

In conclusion, the President spoke of the transcendent importance of the work in which sanitarians are engaged, and of the high honor that awaited him who should discover and demonstrate the specific causes of even one of several important diseases that afflict the community. He closed his address as follows: —

"To prevent disease, suffering, and death among our fellow-beings, is the high aim that is constantly before us as sanitarians. Surely no higher, no more worthy object, no stronger inducement for labor, can be presented to human beings. Every laborer in the work, whether in the field of sanitary investigation, or in that of the application of sanitary knowledge to the pre-

vention of disease, may well rest satisfied in the consciousness that his work is sure to be a blessing to his fellow-men, and to receive the approval of his Maker."

ABSTRACT OF REMARKS BY HENRY I. BOWDITCH, M. D.

INTRODUCTORY TO THE DISCOURSES IN HUNTINGTON HALL, BOSTON, OCTOBER 5, 1876.

DR. BOWDITCH opened with a series of facts from recent experience to show how neglected sources of disease injure cities and towns. The influence of drainage and thorough scavenging on the health and welfare of communities was set forth, and the importance of constant sanitary observation and discussion concerning the causes of destructive diseases, or of impaired health and vigor. The prevalence of phthisis pulmonalis in particular localities, and even in the same house, however numerous the changes of residents; the unhealthfulness of particular streets, and the direct agency of defiled water-supplies in producing sickness, were mentioned in evidence of the necessity for the interference of sanitary inspection and laws to protect the public health.

The evidence of subtle and easily transported contagion, or infection, of diseases was presented in the history of the house-epidemics, of enteric typhoid fever, which have been traced to the milk defiled by the absorption of the infectious poison of that malady at the farm-house where that fever prevailed. As President of the State Board of Health of Massachusetts, he affirmed the doctrine of a reasonable and faithful interposition of sanitary science and legal authority to prevent and control the preventable causes of disease and untimely death.

Dr. Bowditch introduced Hon. Mr. Henley, of the English Local Government service, and called upon him for an exposition of the workings of the new sanitary and local government laws. By that exposition of the public health administration in the mother country, the points laid down in Dr. Bowditch's address were shown to be both practical and essential in good local and general government in a populous State.

ABSTRACT OF ADDRESS BY REV. EDWARD EVERETT HALE.

INTRODUCTORY TO THE DISCOURSES IN HUNTINGTON HALL, BOSTON, OCTOBER 4, 1876.

MR. HALE said he would undertake to contradict the common opinion and fallacy that death knows no distinctions. Death *does* make distinctions; hygiene makes equally great distinctions. Even in the crowded districts of Boston, it has been proved, again and again, that superior sanitary conditions give almost complete immunity from certain destructive diseases which are charged to Divine Providence. During the prevalence of cholera infantum, in that city, six hundred babes died in the course of some few days. In his own parish, its population was entitled to at least ten or more of those

deaths; its people have great reverence for the hand of God's providence, but not one infant died of the prevailing malady, or from any cause, during that brief period of excessive mortality in the city. He could not doubt the cause of this difference between the *average* population of Boston and the people of a *particular parish* that had learned to be healthy by good living. If his friend (pseudonym) Colonel Perkins were allowed to testify in this case, he would say, "I have been down to see where these deaths occurred and find out whose babes they were and why they died; and it is a fact beyond all dispute, that the very tenements, cellars, back-yards, and alleys where these little ones died, are dark, damp, unventilated, and 'their offenses smell to heaven;' neither their nourishment nor the care of their little bodies is what it should be, and often they have lain in dark places without a whiff of fresh air for days. Parents, nurses, and doctors, even, have come short in their duty to these little ones who have perished, and to others that are wounded for life by the missiles of disease." This friend declares that "the gospel of hygiene is preached and faithfully practiced in the parish that failed to have any baby-funerals in those hot summer days."

A great many men, and especially those who make up what are called corporations, practically ask, every day, "Am I my brother's keeper?" An official of one of our great railroads leading out of Boston, was always asking this question, and he has tried to answer it in a practical way. A good many widows and fatherless children of railroad freight-car brakemen have been left in very humble and destitute circumstances all along the lines of our railways, simply because heads were crushed while passing under low bridges unawares. This official, who has hard common sense, but uses few words, has succeeded in saying to every brakeman in the State of Massachusetts, without opening his lips: "Look out for the bridge ahead! Down quick! before the low bridge is reached." This mute railroad officer insists that he is his brother's keeper, and those lines of fimbriated suspenders that we see stretched above the tracks and cars not far either side every railroad bridge, are ever repeating to brakemen on the tops of freight trains, "Down quick! the bridge is ahead!"

Save life! Protect health! must be made popular mottoes and watchwords. Epitaphs and monuments may have their uses. Englishmen point proudly to some of those in Westminster Abbey and Trafalgar Square; but no man need ever seek a grander epitaph than words which would say, in honor of some masterly officer of health, "I found the yearly death-rate of Boston *twenty-eight;* I left it *fourteen.*"

REPORT OF INFORMATION RECEIVED CONCERNING THE PUBLIC HEALTH AND THE PROGRESS OF SANITARY WORK DURING THE YEAR 1876.

By THE SECRETARY OF THE ASSOCIATION.

From nearly eight hundred correspondents and officials who have a recognized interest in public hygiene, the Secretary of the Association has received information or requests during the year. The following abstract presents such facts as are deemed most important for the information of members of the Association and the promoters of sanitary work.

The State Boards of Health. — Of the ten States which have authorized the organization of central boards of health, Alabama, Louisiana, and Virginia still fail to provide the ways and means necessary for maintaining efficient services of the board. The seven States which have the moderate pecuniary aid required, have developed very useful systems of inquiry and record of the sources of prevailing diseases and endemic outbreaks, and have disseminated sanitary information and suggestions which practically exemplify the first purposes of a State Board of Health. The local boards of health have been greatly stimulated to useful activity by the State boards. In Alabama and Texas, the failure of the people to respond to the efforts of medical men to organize effectual methods of sanitary administration, bids fair to result in a presentation of sound reasons for the interposition of national legislation upon questions of external sanitary police and the care of contagious diseases. The general causes of disease, the improvement of school-room hygiene, and the popularization of sanitary knowledge, have received more and more attention by these central boards. The medical profession, civil engineers, public health officers, and the educated classes generally give aid to the State boards.

The duty of organizing and superintending the registration of vital statistics for the State, as now required of the Boards of Health in Georgia and in Wisconsin, may be so performed as to contribute greatly to the public health service, but not without increased expenditure for stationery and clerical work by the board. This experiment is being satisfactorily tried in the two States above mentioned, while a general supervision of the forms and details of the registration of vital statistics is successfully undertaken by the State Boards of Health of Michigan and Minnesota. The States of Virginia and California imposed this entire duty upon their respective Boards of Health, but at the same time made no provision for maintaining the cost of the work. The mere supervision may be practicable without adding to the official expenses by a State board ; but to supply the printed forms and defray the cost of the State office of registration, will require nearly as much money as any State has seemed willing to give for all other expenses of its Board of Health. In view of this fact, none of these boards will seek to burden itself with these duties for which they have no means to defray expenses. Directory supervision, and not the clerical and bureau service of the registry of births, marriages, and deaths will, for the present, be all that can justly be required of the State boards of health in this matter.

Local Boards of Health. — The increasing efficiency of local boards of health has been coincident with the increase of sanitary knowledge among the people, and seems more dependent upon the latter circumstance than upon the few amendments of law which have been enacted in certain States. The general powers conferred by statutes upon local boards of health afford ample ground for the organization of such boards, but the statutes do not set the local authority in motion, and that authority is rarely moved to action except by the urgent pressure of physicians and energetic public men. During the past year or two it is evidently true, however, that in numerous instances, the State board has incited activity in the local boards. The former has disseminated information and useful suggestions, and has opened a channel of official correspondence which local boards and the edu-

cated classes have used in a most practical way. The appeals to a State board for suggestions and even for expert opinions in regard to local sanitary questions, have thus far been happily adapted to illustrate proper relations of local to central boards of health.

The limitations of municipal and town authority in the enforcement of sanitary laws leave nearly every city and village exposed to nuisances and various evils detrimental to health which lie beyond city and village boundaries. The domain of sanitary law and jurisdiction should not be thus rigorously circumscribed. The areas of public health administration cannot always be limited by the town boundaries. Recent efforts have been made in the State of New York to secure for any local board of health the right to initiate proceedings for suppressing great nuisances against the public health, even when their sources are found beyond the limits of the municipality that demands the suppression of such evils. Though no legislation has thus far been secured for this purpose, the effort proves that in some way a recognized sanitary officer or representative should find a standing before any tribunal that has jurisdiction in the premises. As all local boards can appeal to a State board, the best interests of the public health and the most perfect equity may be attainable through the interposition of such a central board rather than in aggressive proceedings and a prosecution in the courts.

Local boards of health are testing the value and authority of local ordinances for securing the certificates on which the registration of vital statistics depends. Every efficient municipal sanitary board has brought to bear the authority it can command to improve the records of mortality, and generally to render the vital statistics complete for the population within its jurisdiction. But, up to the present time, no city has its vital statistics satisfactorily registered under the authority of local laws and ordinances. The faithful endeavors of the city boards of health to secure the complete registration of births, marriages, and deaths, have resulted in greatly improving the accuracy of returns of causes of death; but no local authority, unaided by a State system, has yet succeeded in giving anything like completeness to records of births and marriages. There seems to be no exception to the rule that the best local boards take the lead in the effort to obtain a perfect system of registration of births, marriages, and deaths, under State authority, and their experience shows that State laws which should regulate the registration of vital statistics, must require the local sanitary authorities to enforce a strict compliance with all the rules concerning records of mortality. Accurate and complete statistics of the causes of death are so essential, both to the progress and applications of sanitary science, that local boards and officers of health not only seek the most perfect records they can secure in this branch of statistics, but, for obvious reasons, must be held responsible for the revision and verification of them.

Observations and researches relating to preventable causes of disease and excessive mortality have occupied the attention of local sanitary authorities more and more. Contagious and infectious diseases have been subjected to severe sanitary regulations, while the convenient terms, "stamping out," extinguishing, and destructive disinfection of contagion, have become more frequently and intelligibly used by sanitary officers and other medical men.

The following abstracts of information from correspondents present the more important facts relating to the sanitary condition of the localities which they represent in the several States. Each correspondent has added some practical points relating to the public health service in his city and State.

ALABAMA. — *Huntsville.* Dr. Lowery writes that, "During the autumn there have been fewer cases than formerly of malarial fever, and this is attributable to the fact that obvious sources of malaria had been removed from the city, which had already been placed in an improved sanitary condition. There is great prejudice against vaccination, arising from the fact that there was much spurious vaccination during the war. The inhabitants now submit willingly to vaccination only in the presence of small-pox."

Mobile. Dr. Jerome Cochran has forwarded a great amount of useful information, and none of it is more important than that which relates to the conquest over small-pox. "Beginning with a single imported case in April, 1874, only nine houses had been visited by it up to October 1, of that year; but in October and November, two hundred and sixteen houses and tenements were invaded by the contagion, and in the succeeding two months, two hundred and eighty-four habitations were invaded. By this time the health authorities

presented an organized resistance at the point of the lancet and speedily arrested the progress of the disease."

California. — *Sacramento.* The secretary of the State Board of Health writes: "The physicians of California have, as a general rule, to work hard for their living, which leaves them but little time for scientific or literary pursuits. Our State Board has been so disgusted with the discouraging and unjust criticisms of the eastern journals, that there has been great difficulty in getting it to work at all. If it comes in your way, please send us a word of encouragement and some sign of recognition."

San Francisco. The health officer writes: "The difficulties we labor under arise from want of sewers; want of power (law) to compel the abatement of nuisances on the property of non-residents; want of power on the part of the board of health to give any assistance in the matter, and smallness of force. We have but *two* health inspectors to our city of 230,000."

Florida. — *Jacksonville.* Dr. A. J. Wakefield and Dr. R. P. Daniel write that "Septic fever, originating in the bad sanitary condition of our city market, proved fatal in six cases of those whose business confined them to that part of the building where fresh meat was sold; it was directly traceable to poisonous exhalations from decaying animal matter.

"Ocean Street, between Bay Street and the river, has for twenty years been used as a site for the city market, which was a low, one-story structure, open on all sides. The water from the river flowed under it, and for about four feet on either side, where much of the débris of the market was allowed to accumulate and decompose, the action of the wind and tide preventing it from flowing out into the river. The past summer, for about three months, from the middle of May to the last of August, the wind prevailed from the south and west, without any rain to keep the river at its usual height, leaving it bare under the north end of the market where there was the largest accumulation, and less exposed to view; the wind also causes the water to flow more directly to the sea and prevents the tide from rising as high as when the wind is from the east; consequently we had low water for a long period. The condition under the market was said to be very filthy; dead animals, and in some cases meat that had spoiled, had been thrown under it.

"The Board of Health, with the City Council, caused the inside of the market to be removed, the floors taken up and the slip disinfected and filled with fresh earth, which arrested the disease. Those not yet attacked, but showing premonitory symptoms of the disease, changed their location, gradually recovered, and no other cases occurred."

Illinois. — *Charleston.* Dr. W. M. Chambers writes: "A remarkable feature connected with this region of country is the fact that the percentage of deaths from consumption has greatly increased, and in proportion as malarial diseases have diminished. This country commenced its growth about forty years ago, and until the past fifteen years, all the inhabitants had chills and fever; but a case of consumption was unknown among the people unless it was imported; now, there are occasional cases among the natives of the country."

Chicago. Dr. J. W. Danforth asks, "Would the general introduction of water-meters be a wise measure from a sanitary point of view? Some cities, our own (Chicago) included, are pressing the subject of water-meters upon their local legislative boards. . . . Is it wise or economical, and ought it to be approved by practical sanitarians? Is it safe to adopt a measure that says to the poor man that he must buy water by the gallon, or go without his daily bath?"

Peoria. Dr. J. N. Niglas, the health officer, writes: " . . . . Regarding malarial districts, Peoria for the last ten years has within her limits no avenues favoring malarial disease. By drainage, all standing water has disappeared, and all the sewerage is carried into the river."

Quincy. The secretary of the Board of Health writes: "The city has no drainage or sewerage systematically planned, because it is situated upon a series of bluffs one hundred and forty feet above the waters of the Mississippi; the authorities have begun a system of water supply from that river, but quite inefficient for the majority of dwellings. The worst nuisances of the city consist in pools of stagnant water, filthy gutters, etc.

"There is no registry of births kept, and it was hard work to get the Board of Health to organize and keep a registry of deaths."

LOUISIANA. — *Baton Rouge.* Dr. Richard H. Day writes: "Baton Rouge is situated sixty-five feet above the level of the sea, is naturally well drained, the surrounding country being of the same elevation and rolling. Our sanitary condition uniformly is far above that of any section of the United States with which I have any acquaintance.

"There have been a few cases of diphtheria, of which twenty-five per cent. terminated fatally. Some cases of enteric, intermittent, and remittent fevers have prevailed endemically, but to no great extent. Six cases of small-pox, introduced from New Orleans, were arrested by isolation, vaccination, and disinfectants. The cases are either isolated at home or removed to the hospital, and designated by the 'yellow flag.' Vaccination is pretty thoroughly practiced."

New Orleans. Yellow fever reappeared during the latter part of summer (1876) in such manner as to test the utility of the "stamping out" treatment of the infected localities by disinfectants. The report of Dr. C. B. White, of the Louisiana Board of Health, as published in this volume of Transactions, is in evidence on this subject.

Shreveport. The health officer writes that "four cases of typhoid enteric fever originated in one house situated on a plat of made land near the mouth of Cross Bayou. House and premises were condemned by the Board of Health."

MASSACHUSETTS. — *Boston.* The actuary of the State Board of Health writes: "The Board of Health finds its greatest embarrassment in the defective system of sewerage. So long as this continues, constituting in fact a stupendous nuisance, there is only measurable satisfaction in maintaining cleanliness in the minor particulars. A commission is now occupied with investigations upon this matter, and is charged with the duty of reporting some tangible and practicable measures of reform.

"Very generally the night-soil of Boston enters the sewers, and is discharged into the harbor, or upon the tidal flats around the city.

"In this community there is a lively and increasing interest in all matters pertaining to public hygiene. The labors of the late Dr. Derby gave an impetus in this direction, and it will be very long before his valuable service and zeal will be forgotten. In all matters of sanitary administration there is a wholesome sentiment which looks with favor on the efforts of the Board of Health, and the measures of the Board are well sustained."

MICHIGAN. — *Lansing.* Dr. J. H. Bartholomew, of the Board of Health, communicates the following information concerning the coöperation of physicians and the educated classes in that city, for promoting sanitary knowledge, and the action concerning sanitary wants. The condition of sanitary matters in the city of Lansing has become quite satisfactory, and this is the way it has been brought about: "By our charter, the Board of Health is authorized to *order* any person owning or accepting a lot on which any nuisance exists to forthwith abate the same; a failure to obey involving pains and penalties. The Board employs an agent to whom all complaints are referred, who immediately visits the premises, and if the nuisance exists, a notice is served; and so far, our experience is, that very cheaply and thoroughly we succeed in accomplishing our object.

"One of the greatest difficulties we had to meet was the disinclination, and sometimes fear, of parties to complain of nuisances on a neighbor's premises. Often it was found that very offensive nuisances were permitted to exist, rather than offend a neighbor or friend by giving notice to the Board. To obviate this, the Board published in the city papers a notice that anonymous communications would receive the same attention as if signed, or as much as a petition numerously signed. Immediately such notices were sent to the Board, and they continue to be received daily with very great advantage to the sanitary interests of the city.

"I am thoroughly satisfied that it is a means which every Board of Health should avail itself of to obtain necessary information."

Dr. H. B. Baker, secretary of the State Board of Health, makes the following statement concerning death-rates in Lansing: "*Healthfulness of Lansing.* — The death-rate in this city during the year 1874, computed from the sexton's record of burials in the city cemeteries, is as follows: —

Statements for the year 1874.	Total.	Males.	Females.
Inhabitants by census in May	7,445	3,834	3,611
Deaths from all causes	76	39	37
Deaths from consumption	12	4	8
Per cent. of consumption to all deaths . . .	15.79	10.26	21.62
" " all deaths to 1,000 inhabitants . .	10.2	10.1	10.2
" " from consumption to 1,000 inhabitants	1.6	1.0	2.2

Although this death-rate is remarkably low, there seems to be no reason to doubt the accuracy or completeness of the record of burials, or the fact that this record includes all the deaths of inhabitants of the city during the time specified. The statement of inhabitants is from the official papers in the office of the secretary of state.

MISSISSIPPI. — *Corinth.* Dr. J. M. Taylor writes: "If the physicians and educated classes in our State could be induced to coöperate on some practical plan, boards of health could be sustained, and a system of registration laws and many sanitary improvements might be effected."

MISSOURI. — *St. Joseph.* Dr. W. I. Heddens writes: "Our city of 38,000 inhabitants has scarcely any health regulations.

"Typhoid pneumonia, and typhoid and intermittent fevers have prevailed; pneumonia and bronchial affections of a congested type were fatally prevalent in the winter.

"Malaria in the city proper is rare, but there is abundance near the Missouri River and the lakes."

NEW JERSEY. — *Elizabeth.* Dr. L. W. Oakley writes: "There have been a few severe cases of diphtheria, and pneumonia caused greater mortality than usual, *but otherwise* we have had a year of uniform healthfulness.

" . . . . We have no State laws regulating health. Our city laws are fair, if properly enforced. The Board has enforced them in cases of emergency, but its efforts are spasmodic."

Montclair. Dr. J. J. Love writes: "Remittent fever has prevailed, and pneumonia has been very prevalent and fatal in persons over sixty years of age. House-drainage and sewerage are matters which come home to us daily. In common with the cities of Newark, Jersey City, and Paterson, and all the region east of Orange Mountain, we are deeply interested in the question of future water-supply, for we know that such a foul source as the Passaic River must cease to be used."

Trenton. Dr. J. L. Bodine writes: "Our State law for the registry of deaths is utterly valueless. Our Board of Health is a creature of, and derives all its powers from, our Common Council, or city legislative body. The health board has practically no power.

"Privy-vaults honey-comb the soil, which, together with the atmosphere, is polluted. We have no sewers and no efficient drainage. The natural drainage is obstructed. We live in a visible, and, to the sense of smell, an appreciable atmosphere."

NEW YORK. — *Astoria.* Dr. J. D. Trask writes: "During the past twelve months, pneumonia and diphtheria have prevailed; intermittent fever has occurred more or less in various portions of this region of Long Island. Its prevalence within a few years past is clearly due to obstruction of the natural drainage by filling in of streets, and neglect on the part of the authorities to compel the re-opening of drains that have in process of time gradually become filled. Some seven or eight years ago, Ravenswood was rendered almost uninhabitable, from the filling in, during the construction of a public turnpike, of the outlet to certain swamp lands in the immediate vicinity of the settled portions of the place. After two or three years of the universal prevalence of malarial diseases, the Board of Health ordered the opening of the original watercourse, and the disease almost entirely disappeared the following year and has not returned.

"We have been passing through the most extensive and the most severe epidemic of diphtheria that I have ever known. It has proved very fatal. A most suggestive fact, in

reference to the epidemic, is this, that it commenced in, and for a long time was confined to, houses situated upon the two principal business streets of Astoria, of which the gutters are always filthy in the extreme. Besides this, the soil is saturated by privies and cess-pools. Not a case of the disorder occurred on streets lying upon the north side of one of these two streets, this being the portion of the town most elevated, and occupied by the more comfortable classes. It is true that the disease prevailed in a sparse settlement some two miles to the east, but in a locality where there is no drainage, and surrounded on all sides by swampy ground."

Batavia. Dr. L. B. Cotes communicates the following information: "The subject of hygiene is assuming very large dimensions, and it has for its foundation the educated common sense of the world. The laws of health were established from the very commencement of human experience as surely and positively as were the laws of morality and religion. From this standpoint we reason and make our efforts.

"The village of Batavia is located upon what was originally a morass. The forest being swept away, and malarial disease having ceased to exist, this village continued to be comparatively, for twenty years, among the healthiest. Ditching and sewerage have been carried on to a large extent, and are progressing, — the vicinity of the Tonawanda Creek, and the natural drainage, facilitating. We have now, however, malarial districts and limited sources of malaria. It is a notable fact that malarial disease has been gradually increasing and spreading over all of our level area, in Brooklyn and other localities in this State. In this county there are ponds and considerable marshy land that become dry, principally during the summer and autumnal months, and as our prevailing winds are from all points from northwest to southwest, the inhabitants at the points from southeast to northeast of these lands are more apt to be sickly. Some of these lands are in the vicinity of this village, and could be drained.

"In 1871, the authorities of this town authorized preliminary surveys and engineering to the amount of several hundred dollars, which demonstrated the feasibility of drainage; at this stage it was discovered that there was no law in force to authorize them to carry out the plan and the project was abandoned for the time being; an attempt was made to procure local legislation, and this failed also, and autumnal fevers continue. About fourteen hundred (1,400) acres of the Tonawanda Swamp (so called) border this county on the north. Our experience is, that local legislation has proved ineffectual, and this county is very desirous to see a general law in full force.

"In regard to the remedy to prevent the evil of small-pox in our cities, I charge that our State governments are largely and criminally at fault in not making it obligatory that every child should, at a specified age, be vaccinated; with the aid of an adequate and well-regulated system of re-vaccination, this pest may be exterminated."

Cold Spring. A local physician writes: "Malarial diseases have prevailed in this village and vicinity for four years past. Malarial fever spreads up on the hills and among the mountains, as well as among the lowlands along the river. The cold changes of early autumn have rather increased it, as heretofore. The water, running down from some large ponds (dammed up) where it had been slowly collected during hot and dry weather seemed to start the epidemic about four years ago.

"Scarlatina has been prevalent, and there have been a few cases of diphtheria. Intermittent fever has prevailed to an unusual extent in this region for the past four years; it has coincided with the *drought* which has prevailed during the same period, and has been unexampled. I regard the two in the relation of cause and effect to a certain extent; the effect on the quantity, and probably the quality, of the water in the springs, and the drying up of the swamps and little rocky basins and depressions which have heretofore been covered with spring water, have rendered the fever more virulent and difficult to manage with ordinary remedies each year of the epidemic. Its course is very irregular."

Corning. Dr. H. C. May writes: "Erysipelas never prevails epidemically; child-bed fever is rare; pulmonary complaints carry off a good many in the winter and spring months, mainly among our large Irish population. Our foreign citizens generally live in well-built frame-dwellings. Pulmonary consumption reaps a large harvest in this town; diphtheria, during the last spring, prevailed to a limited extent; but the type was malignant, and nearly every severe case proved fatal. They were mostly on two blocks at the foot of the hill,

where water sometimes stands and evaporates; two fatal cases in one family occurred on the hill, 250 feet higher than the above-mentioned locality."

Ithaca. Dr. S. J. Parker writes: "Scarlatina, intermittent and other forms of malarial fever, neuralgia, rheumatism, and epizoötic catarrhal fever have prevailed during the past two years. The Board of Health has not authority for the work of drainage that is needed in the marshes about the head of Cayuga Lake, hence the sources of local malaria remain.

"Two-thirds of the plain of Ithaca is a malarial district. Nothing can be done without a vast expenditure for the drainage of the distant outlet of Cayuga Lake. All our diseases are modified by malaria. The Cornell University and its hill-site are not malarious to any serious extent. The change produced by malaria is to make all other diseases less severe and more easily controllable. Our physicians are skillful in malarial diseases and easily control all except the slow exhaustion, which malaria produces."

New Brighton, S. I. Dr. Alfred C. Carroll, the local health officer, writes: "The desiderata for public health, here as everywhere, are: 1. Drainage of the soil, against which the average Staten Islander entertains an apparently unconquerable prejudice. 2. In thickly settled neighborhoods, a system of sewerage to do away with cess-pools and other reservoirs of decomposing organic matter. 3. A pure and sufficient water-supply. As population increases, surface wells are more and more liable to pollution; and in several instances I have found rain-water cisterns (which are more commonly used here) contaminated through overflow-pipes connecting with adjoining cesspools. In the interior districts, the introduction of the dry-earth system would be a great and economical improvement; but this, too, is too much of an innovation on ancestral usages to be generally adopted. The death-rate of Staten Island, though too large for a rural population (about 23 per 1,000 in 1873, and 21.6 in 1874), will, perhaps, compare favorably with that of a majority of similarly unpoliced suburban districts; but there can be no question that much of its mortality and more of its sickness could be prevented by intelligent sanitary supervision."

Ogdensburg. Dr. B. F. Sherman writes: "When the canal and bason are drawn off for alterations or repairs of the mills, every summer, more or less, we have evidence of malaria in that neighborhood. In former years, when the water was drawn off from the pond, for rebuilding or repairing the dam on the Oswegatchie, or when that stream has been very low, we have had malaria upon its borders; but since the reservoir on Cranberry Lake was built, the water never gets very low in the pond."

"We have a very perfect system of drainage planned and laid out by George E. Waring Esq, and when completed, our city will be perfectly drained. House-drainage and sewerage are bad in most parts of the city. In many streets there are none but the old sewers, which are nothing better than an extended cesspool, with no means to prevent the gases from poisoning private dwellings through the drains, and the whole atmosphere from the openings at the street corners.

"The water-supply is abundant and of good quality from the Oswegatchie River, but it is not as generally used as it should be, though every year its use is becoming more general and the mains are extending.

"The only infectious fever we have is enteric or typhoid. I never saw a case of typhoid fever here till after 1847, when there was so much of what was called ship-fever, made up, as I believe of typhus, typhoid, and relapsing fevers. The St. Lawrence was the great thoroughfare for the immigrants going west. In every port at which the boats touched there were left some of the sick, dying, and dead; the fever gained a foothold here, and from what I have said above, it would retain it. The source is most often *foul privy vaults*, by which the water used from neighboring wells is poisoned, or the atmosphere, by the escaping gases. It should be made a penal offense to construct such a vault."

Rochester. The health officer writes that, "sewer gases and defective drainage are active causes of fatal diseases in the city. Scarlatina, diphtheria, and enteric fever have prevailed in localities most afflicted with sewer gases and dampness. The medical profession has presented the evidence on this subject and thoroughly aroused public attention to it. The water-supply has been greatly improved by means of an aqueduct which conveys the supply from a highland lake nearly thirty miles distant.

"The records of death in Rochester have been so well kept by the successive health

officers that the rate of mortality and the classified causes of death in that city have become subjects of useful study. The death rate has seldom risen above 17 per 1,000, annually. Diarrhœal diseases, pneumonia, and bronchitis have given higher percentages in the total death-list than numerous cities have experienced on the Atlantic slope. The bowel diseases are diminishing under the improved water-supply from a distant highland lake. The medical profession of the city, and of the county in which it is located, recently made a concerted movement for procuring such improvement in the State laws as will secure the adoption of a suitable system of registration of vital statistics."

OHIO. — *Dayton.* Dr. Thomas L. Neal, health officer, writes: "We have no sewerage; our house-drainage is imperfect, and, where any exists, it is into sinks, the bottoms of which reach the gravelly subsoil. The water-supply is from wells. The public supply from a district protected from all sources of filth contaminated by prohibitory law. . . . . There is fair coöperation in the promotion of sanitary knowledge and improvements, which can be relied upon in support of a State Board of Health and the registration of vital statistics."

Marietta. Dr. S. Hunt writes: "Our City Board of Health seems ready to do what it may, by way of prevention, and we have had no endemic or epidemic requiring particular attention. Physicians here will readily coöperate with the educated classes in sanitary matters; but physicians everywhere must take the lead; for the intelligent and educated are singularly ignorant of the most simple and important sanitary requirements! Physicians themselves should make *Prophylaxis* more their first duty and study; they must assist in the public sanitary education by the teaching of whatever is already established and placed in accessible form."

Newark. Prof. J. R. Black communicates the following: "Diphtheria has prevailed and is quite fatal (as many as four children in a single family). No steps are taken by the health officer to limit the spread of infection. Scarlatina, in a mild form, also lurks in our city. . . . In cases of small-pox, sanitary police guard the house day and night to keep others away; this, together with the practice of systematic disinfection, has entirely prevented the spread of infection. . . . .

"Vital statistics are very carelessly kept."

Norwalk. Dr. S. Lynes writes: "Malaria has prevailed the past ten years over the whole section from New York to the Connecticut River, at first confined to a belt immediately on the shore of the Sound, now gradually extended inland to an average distance of fifteen miles or more. There is no sanitary drainage to any extent, except by private persons in a limited manner. Water-supply is abundant and good at public expense, and under pressure.

"Infectious fevers among us are altogether chargeable to filth and ignorance.

"The *general* coöperation of society in promoting sanitary knowledge, etc., could not be *now* obtained without much effort. It *must* come, of course, but only by slow and long-continued effort, I fear. That of our physicians is always ready."

PENNSYLVANIA. — *Erie.* The city health officer writes: "Last year I discovered some cases of *trichina* in our city; the hogs came from the West, but were fed here. Almost all the pork used was examined with the microscope, and the people are getting every day more cautious.

"We have fine school-houses, with plenty of space around them, and well ventilated. We have also a new small-pox hospital standing on high ground, near the lake, with sixteen well-ventilated rooms. . . . .

"A great many improvements have been made in our city, which compares favorably with many I saw in Europe, and between the Atlantic and Pacific. Our physicians, and the citizens in general, do everything possible to remove nuisances of every kind."

Pittsburg. Dr. W. Snively, the registrar of vital statistics, writes: "Scarlatina contributed 8.40 per cent. of the mortality, and typhoid fever was unusually prevalent. Small-pox and diarrhœal diseases were more active than in the previous year."

The health officer of the city writes: "The area of our city is much diversified by hills and ravines. The principal source of water-supply is by the public water-works, which furnish about 90,000 of the population of the old city with an average daily supply of 1,572 gallons per inhabitant. The 'South Side' wards are principally supplied by a private

corporation, which furnishes about 25,000 of the population with an average daily supply of 100 gallons per inhabitant. The balance of our population, or about 22,000, are supplied from other sources, principally wells and springs. We are now engaged in the construction of new water works, sufficient to supply all our population for many years to come.

. . . . "While Pittsburg has six public hospitals, Alleghany City, on the opposite side of the river, has none. We have a number of what are termed *congregate* tenement-houses, and in two or three localities quite a number of small tenement-houses, or rather, hovels, which are occupied by from one to three families, a majority of whom live without the least thought of, or regard for, the laws of health. Alleghany City also embraces a number of the same class. . . . .

"The efforts of our Board are often crippled for lack of coöperation as well as of sufficient funds wherewith to fully carry out the intentions of our health laws."

RHODE ISLAND. — *Providence.* The Superintendent of Health and registrar writes: "Pneumonia was unusually prevalent and fatal last winter and spring, and in the autumn, the close of a long and severe epidemic of scarlatina. . . . .

"Night-soil is removed in air-tight tubs without nuisance or offense to any one. It is required to be disinfected before removal. After the tubs, which hold twenty-four gallons, are filled, the covers are screwed on and the tubs are washed clean. . . . .

"There is public vaccination weekly through the year, and oftener when needed. Nine tenths are vaccinated."

SOUTH CAROLINA. — *Charleston.* A correspondent writes: "During the past two years, diphtheria has been constantly present. A careful study of the origin and mode of extension of the disease has contributed nothing to the present knowledge of the subject. Typhoid fever has also prevailed to an unusual extent. . . . .

"There is now a company in active operation to remove night-soil by the odorless method and to utilize it for fertilizing purposes.

"There is no law compelling vaccination; an ordinance (1858) required that good vaccine virus shall be kept by the registrar for general and gratuitous distribution. The people are, as a rule, aware of the importance of this matter, and the children are generally vaccinated. . . . . The office of public vaccinator has been discontinued."

TENNESSEE. — *Chattanooga.* Dr. J. H. Van Deman writes: "Our Board has no power to define and abate nuisances. Our progress, if any, is embarrassed by defective sewerage, and the mode of disposal of night-soil. We have no sanitary regulations regarding the disposal of offal and waste matters."

TEXAS. — *Austin City.* Dr. M. A. Taylor writes: "The want of the people, — a proper system of education in sanitary matters, — is a great drawback, and prevents the usefulness of local boards of health. This section of country is comparatively free from malaria or miasmata of the lower lands bordering upon its Gulf coast. Situate as we are, at the foot of the Colorado hills, our section is free from the more level and marshy lands of the lower country, and hence our immunity from chills. The section of our State where we find malarial trouble is the eastern, and all that portion bordering on the streams and Gulf coast."

Navasota. Dr. A. R. Kilpatrick writes: "Navasota is a railroad town (Lat. 30° 30′ N., Lon. 19° W.), situated partly in a small prairie and partly in an oakwood (called post-oaks); the prairie-land being black, stiff hog-wallow, while the woods part is light, gray, sandy soil. It is only six miles east of the Great Brazos River, and two miles south of the Navasota River; consequently, we are all the time exposed to miasm and malaria, and all our diseases partake largely of that type and character. Even in the winter, all the diseases, of whatever nature, require anti-malarial remedies at some time of the treatment. In Washington County, the next to this on the west side of the Brazos River, and only six miles from here, there have been several cases of what the laymen call black jaundice and the physicians call hæmaturia miasmatica. This is decidedly the most fatal disease in the country. It bears a strong resemblance to fatal cases of yellow fever. Very few recover from it, and if a case recovers it is liable to another attack later in the season, or the next year, when it is almost certain to die. The disease is most apt to supervene in persons who have been long laboring under intermittent fever and consequently reduced in flesh and their blood attenuated. Owing to this, and to the fact that such persons have taken

large quantities of quinine, some laymen and physicians assume that the disease is caused by quinine. Scarlatina and measles are rare, only a few cases having been seen here in ten years. Cerebro-spinal fever is also very rare, and none in the last two years. No variola at any time; and no epizoötic since early in 1873, and then no fatal cases. Intermittents are our most common form of fevers, and they are not generally fatal, yielding to quinine and cathartics. Enteric fever, or what some of our physicians call typho-malarial fever, is becoming more common each succeeding year, assuming much the character of the enteric fever described by Dr. G. B. Wood, and of the *continued fever* of Eberle."

Waco. Dr. H. W. Brown writes: — "Dysentery has been somewhat active among children, a result of extremes of temperature. There have also been a few fatal cases of pneumonia.

"We have no sanitary drainage, and no system of house-drainage and sewerage; but the natural drainage is very good. . . . .

"There is disease only from malarious districts and extremes of temperature. Ours is an extraordinarily salubrious climate, with a pure and rare atmosphere; the population enjoy health, and live longer than the average of our States."

VIRGINIA. — *Abingdon.* Dr. W. F. Barre writes: — "There is no local board of health here, and no power or means to abate nuisances. . . . . "Epidemic influenza and epizoötic have been very prevalent, but not fatal. There are no malarial districts in this county (Washington), and no infectious fevers. There is no sanitary drainage, and the house-drainage and sewerage are defective and bad." . . . . "Our water-supply is from wells and springs."

Salem. Dr. Frederick Horner, late surgeon U. S. Navy, wrote: "The failure to clean out the wells, springs, etc., in the Piedmont district of Virginia, and long-continued drought, have caused typhoid fever and fatal diarrhœa in summer. Phthisis pulmonalis has increased in fatality among the whites and negroes of late years, though subsequently and soon after the late war, this disease was comparatively infrequent. Typhoid fever prevails in every part of this community, in the villages, towns, and rural portions of the country lying near the Blue Ridge Mountains. It sometimes proves fatal from perforation of the bowels."

WEST VIRGINIA. — *Parkersburg.* Dr. R. P. Davis writes: "We have no Board of Health in our city. Efforts have been made for a State board of health, which we hope will be successful. . . . .

"We have a small-pox hospital, and the children of our city are well vaccinated."

Wheeling. The health officer writes: "Scarlatina has prevailed very extensively in the Eighth Ward, and to a less extent all over the city. Diphtheria has also been very fatal.

"During July last, we inaugurated a new garbage-cart system. An ordinance was passed that all persons should provide on their premises a receptacle for garbage and kitchen offal; that this should be removed by contract in water-tight, closely covered carts at stated periods, — daily in warm weather, less frequently in cold; the blowing of a horn to announce the approach of the collector, and no garbage to be kept in the streets or alleys except long enough to be removed by collector.

"Our law touching small-pox works admirably. It is a punishable offense to bring a case into the city. If a case is brought by steam-boat, etc., the company must give bond to indemnify the city for all expenses incurred in caring for the patient. If a case occurs in the city, it is the duty of the physician in attendance or the head of the family to report the case to the health officer, who visits the house and sees that all exposed persons are properly vaccinated, and that a yellow flag marked 'small-pox' be placed on the house; also, to place a guard over the premises and allow no exit or entrance except to the physician. In case of either death or recovery, the house is under the control of the health officer until proper cleansing and disinfection have been effected. The sanitary wants of the city are being slowly supplied."

WISCONSIN. — *Milwaukee.* A correspondent writes: "The sewerage and drainage of the city are nearly completed; the dwellings are mostly detached from each other and there is not a tenement-house in the city."

CONCLUSIONS AND SUGGESTIONS.

The information received from all parts of the country, a little of which has here been quoted, gives ample evidence upon the following points: —

The general statutes, which provide for local sanitary government, do not provide for a competent official service. Special statutes for the organization of efficient municipal departments of health government, as witnessed in New York City and Boston, show that great improvement in sanitary laws is practicable. Throughout nearly all the States, there is great desire for such improvement in the laws. At the same time the conviction seems everywhere to warrant the request that deliberate inquiry and exact knowledge by a State Board of Health should devise the improvements now desired in regard to sanitary laws.

The legal descriptions and definitions of nuisances, and the various evils that are detrimental to health and dangerous to life, are quite unsatisfactory in all the States. It is necessary to have a sound basis of legal and scientific definitions for the successful proceedings in public health administrations against such evils. State boards of health, and efficient municipal sanitary departments, when empowered by law to define nuisances against health, will meet the existing demand of local sanitary officers for skillful advice and aid in this matter.

The records of mortality are not adequately provided for in any of the States, particularly as regards the verification and individual registry of causes of death; also, as respects the complete and proper registration of births. Central and expert supervision is conceded to be an essential requisite in any such registration of vital statistics as shall suitably contribute to the sanitary welfare of the people.

The sanitary topography of cities and large towns is generally unfavorable to the public health of populous communities. Commerce enjoys its greatest advantages by the low watersides, and the obstacles to sanitary drainage and dryness of such town sites, must be overcome by the skill of sanitary engineering. Even the most fertile and populous districts in many of the States suffer disadvantages to health which can be removed by systematic drainage, the regulated removal of excremental and waste matters, the supplying of pure water to the people, etc. The sanitary engineers, and enlightened sanitary legislators, have become necessary helpers in the work of public sanitary improvement.

The medical profession in all parts of the country is more interested, and has reason to be more earnestly concerned than ever before in the discovery and description of preventable causes of diseases; for such knowledge is required by the people, and is promptly recognized in the proceedings of public health authorities. The disappearance of many of the destructive diseases may become possible, if medical inquiry and sanitary duties are thus persistently coördinated. There is much desire and much reason for the organization and maintenance of expert researches into the natural history and causation of the diseases against which sanitary authorities are ever directing their chief efforts.

The diffusion of a popular knowledge of the laws of healthy living, and of physiology, is desired by all true workers in the public health service. The ablest sanitary officers and medical inspectors are practical advocates of this duty, and of the instruction of teachers and pupils in human physiology.

AMERICAN PUBLIC HEALTH ASSOCIATION.

ABSTRACT OF MINUTES OF THE FOURTH ANNUAL MEETING.

BOSTON, OCTOBER 3–6, 1876.

THE Association convened in Huntington Hall, Boston, Mass., at half-past one P. M., Dr. Edwin M. Snow, President, in the chair.

An address of welcome having been given by Professor Wm. Ripley Nichols, the President, Dr. Edwin M. Snow delivered the opening address. A paper and propositions on "Sanitary Regulations Relating to Abattoirs," by Henry G. Crowell, Esq., of the Boston Board of Health, was followed by a general statement of the business of slaughtering in New York State, of Abattoirs and laws concerning them, by Dr. E. H. Janes, Assistant Sanitary Superintendent of New York, who subsequently offered the following resolution which was adopted: —

"*Resolved*, That concentration of the slaughtering business in large abattoirs located at the water-side below cities, when possible, and remote from business centres and human dwellings, provided with facilities for utilizing all portions of the animal without delay, is regarded as essential for the protection of public health and as conducive to individual economy."

SECOND DAY. — After a meeting of the Executive Committee, the Association was called to order at ten, A. M. (Dr. Edwin M. Snow, President, in the chair) and proceeded to the election of new members as nominated by the Committee. (See list of new members.)

The proposed amendments to Articles III. and VIII. of the Constitution were considered and unanimously laid upon the table. The report of the Treasurer was submitted and referred to an Auditing Committee.

On motion of Dr. Toner, it was voted that the resolution submitted by Dr. Janes, in his paper, be reconsidered so far as the action thereon had been taken by the Association, but that the resolution, as originally offered, should be considered one of the conclusions of the author's paper.

Hon. Emory Washburn read the first paper, on "Expert Testimony," which was discussed by Professor H. P. Bowditch, and others. The discussion was continued by Hon. Emory Washburn (on the resolution, offered on behalf of Prof. Wolcott Gibbs, as follows: "*Resolved*, That a committee of five be appointed to inquire what methods of obtaining expert testimony prevail in European countries, and to report at the next meeting of the Association, the recommendation of an improved plan of procedure based upon the information thus received." Adopted unanimously.) — Laws here and in Europe differ; no juries often in civil cases; the accused has a right to meet not only his accusers, but also the witnesses in the case; the theory of trial by jury under common law in this country is different from that which prevails generally in Europe; the secrecy and wrongs of Star Chamber inquisitions really originated the practice of confronting the accused with his accusers; no hearsay evidence is allowed, even on oath.

Dr. Bowditch said that Professor Gibbs specially wished a report to be made upon the forms adopted in presenting expert testimony before the courts in European countries, so that a substantial basis could be attained for improved practice in this country. Professor Gibbs' motion was seconded by Dr. Harris and adopted. Professor Horsford resumed the discussion: Experts considered here as belonging to the counsel, not to the court; law-

yers take little or more testimony as they please, to suit their cause; experts and lawyers equally blamable; experts yield to the lawyers, though not from want of rectitude; in Austria, judge takes testimony of experts and gives his decision to the judge presiding; experts not brought personally into court. Professor Horsford thought it important that "there should be some practicable plan in which legal counsel on both sides may readily concur." The discussion was continued by Professor Ordronaux, Commissioner in Lunacy, of New York, and Senator Steiner, of Maryland. The motion of Professor Gibbs was then adopted. A paper by Dr. Steiner followed.

At the termination of this discussion, the order of addresses, etc., for Wednesday and Thursday evenings, was presented. A volunteer paper was read by Professor Horsford. A motion was adopted that the abstract by Professors Gibbs and Bowditch, and the papers of Professors Washburn, Horsford, and Ordronaux be furnished to the Executive Committee for publication.

The meeting adjourned to 8 P. M.

Evening Session. The President introduced Rev. Edward Everett Hale as Chairman for the evening, who briefly addressed the Association on "The General Health of Cities, in its Effects on the Inhabitants, Morally and Physically."

Professor Austin Flint then delivered an address on "The Relation of Food to Personal and Public Hygiene;" a short extempore address followed, relating to the physical condition of the pupils at the School of Technology as affected by food and exercise, and especially by a hearty mid-day lunch.

The meeting adjourned to Thursday, 9 A. M.

THIRD DAY. — Professors Wolcott Gibbs and Emory Washburn of Boston, Dr. Stephen Smith, and Professors Ordronaux and Yeaman of New York, were appointed by the President as a committee in pursuance of Professor Gibbs' resolution; and Drs. Billings, Rauch, and Steiner, were appointed as an auditing committee upon the Treasurer's accounts.

The annual election of officers of the Association was then entered upon, and after an informal ballot, it was voted by the Association that Dr. Rauch cast its vote for the reëlection of Dr. Harris as Secretary. The Secretary then, by order of the Association, cast its vote for Dr. J. Foster Jenkins as Treasurer, Dr. L. H. Steiner as 1st Vice-president, and Dr. Ezra M. Hunt as 2d Vice-president. Dr. J. H. Rauch was then elected President for the ensuing year.

After an informal ballot for the Executive Committee, the highest, as follows, were voted for and elected: Drs. John M. Woodworth and John S. Billings, of Washington, D. C., Dr. Albert L. Gihon, U. S. Navy, Jackson S. Schultz, Esq., of New York, Dr. Charles F. Folsom, of Boston, and Professor Hosmer A. Johnson, of Chicago.

The reading and discussion of papers for the day were opened by Professor E. S. Wood, M. D., on "Illuminating Gas in its Relation to Health," which was also discussed by Drs. Billings, Gihon, and Lincoln. A paper was then read on "Sanitary Requirements in Large Factories," by Dr. L. F. C. Garvin. After a discussion by Drs. Steiner, Toner, Garvin, and Harris, it was moved by the latter that the resolution of Dr. Garvin be adopted as the sense of the Association. A proposed amendment to substitute fifteen years for sixteen, as the age for children to attend half-day school was lost, and the original resolution was adopted as follows: —

"*Resolved*, That the due protection and welfare of factory operatives require, — 1. Half-day schooling for children under sixteen years of age; 2. Uniform hours of labor, not exceeding sixty per week; 3. Frequent inspection of the mills and tenement dwellings of factory villages, and of the milk sold to the inhabitants by an authorized public health officer."

An invitation to visit the Quarantine Institutions was accepted. The following papers were then read: "Water-supplies for Large Institutions and Small Communities," by J. Herbert Shedd, C. E.; "Naval Architecture and the Need of Sanitary Reform in Ship-life," by Dr. Albert L. Gihon; "The Sanitary Safety of Ships and those who Travel in them," by Dr. J. M. Woodworth; and

"Practical Conclusions Concerning Marine Hygiene, Based upon the last Ten Years' Experience of the Ocean Lines of Ships in Communication with New York," by Dr. A. N. Bell.

Evening Session — 8 P. M. Dr. Henry I. Bowditch gave an introductory address.

Dr. Bowditch introduced Mr. Henley, late member of Parliament, inspector of one of the Local Government Board Districts in England, who gave a brief account of the organization of the local government boards of the central authority in England for the inspection of nuisances, drainage, sewerage, etc., and the promotion of improvements in the public health and poor law administration.

Mr. Charlton T. Lewis, Secretary of the Chamber of Life Insurance, New York, followed with a discourse on "Ancient and Modern Hygiene." Dr. John S. Billings made a concluding discourse, on "The Rights, Duties, and Privileges of the Community in relation to those of the Individual as regards Public Health."

FOURTH DAY.—The report of the Auditing Committee upon the Treasurer's report was accepted. The Executive Committee reported that papers from Dr. C. B. White, of New Orleans; Dr. John Morris, of Baltimore; Dr. F. D. Lente, of Florida; Dr. Walker, of Brooklyn, and Prof. Black, of Ohio, are submitted to the Association, with the recommendation that they be read and referred to the Executive Committee. Papers by Dr. John Morris, of Baltimore, on "Scarlet Fever in Baltimore and Belair, Md.," and by Dr. C. B. White, on "Disinfection against Yellow Fever in New Orleans," were then read and referred to the Executive Committee for publication.

Drs. J. Foster Jenkins, L. H. Steiner, and J. M. Toner were appointed a committee to memorialize Congress concerning the completion of the bibliographical publication in the "Army Medical Bureau."

Prof. J. T. Gardner, C. E., read a paper on "Topographical Surveys and Maps in their relations to Public Hygiene." A discussion followed by Professors Pickering, Runkle, T. Sterry Hunt, J. D. Whitney, and Drs. Bell, Billings, and Harris.

The following resolutions were adopted: —

"Whereas, This Association has projected and wishes to encourage a systematic and complete Sanitary Survey of the United States, and fully appreciates its importance, —

"*Resolved*, That it is the opinion of the American Public Health Association, that in every State, especially in the populous ones, a thoroughly accurate topographical survey is so essentially necessary as a basis of sanitary surveys and systematic drainage, and also of the most desirable researches and works for the prevention of disease, that the execution of such State survey is a public work which should be undertaken by the State government as a duty to the life and welfare of the people.

"*Resolved*, That the Committee on a Preliminary Sanitary Inquiry and Survey is requested to confer with the Superintendent of the Ninth National Census, the Commissioners and Director of the State Topographical Survey of New York, and with the Superintendents of Censuses in each State, and other expert and official authorities, with reference to the work which this Committee is projecting.

"*Resolved*, That the statement of the sanitary aspect of Topographical Surveys and Maps, as presented in Director James T. Gardner's address, accords with the best established facts in sanitary science, and that the prosecution of State Surveys, which will promote sanitary knowledge and human welfare in the manner set forth in this address, is a duty which should be encouraged by the people and the legislatures of the several States."

The Secretary, as Chairman of the Committee on the Organization of a Sanitary Survey of the United States, presented a report on that subject.

The following papers were then read: —

"The Gases of Decay and the Harm they Cause in Dwellings and Populous Places," by Professor Wm. H. Brewer; "The Sanitary Condition of Country Houses and Grounds," by Col. George E. Waring; and "The Sanitary Appointments and Outfitting of Dwelling-Houses, regarded as Essential and Obligatory," by Dr. Ezra M. Hunt. Dr. Lente's paper on "Florida as a Health Resort," was read by abstract.

An invitation to visit the Training School for Nurses was accepted.

The following resolutions were then adopted: —

"*Resolved*, That the outbreak and fatal prevalence of diphtheria, scarlatina, and enteric fever in numerous places in the United States, render it important that there should be placed before this Association, at each annual meeting, a carefully collated body of authentic information concerning these maladies, and all endemic and epidemic diseases that admit of general or specific measures of prevention.

"*Resolved*, That the Secretary of this Association is hereby requested to lay this subject before the Executive Committee at its first meeting, and to use such means as in his judgment seem best adapted to obtain such information at the annual meeting."

"Whereas, epidemic yellow fever has very fatally invaded the coast of Georgia, and already decimated the populations of Savannah and Brunswick, while in several other places its appearance has awakened popular fear and called forth the best exertions of physicians and officers of health, —

"*Resolved*, That in the heroic and dutiful encounter of physicians and other attendants with the deadly epidemic in the places where it is prevailing, the best resources of sanitary science are demanded, and the highest attributes of the medical profession and officers of health are called into action, and that with those dutiful men in the midst of the epidemic, this Association has sincere sympathy, while in common with them, we all need to be incited to the application of sanitary knowledge for the mitigation and prevention of such pestilent visitations."

Upon invitation of the President elect, Dr. J. H. Rauch, it was "*Resolved*, That when this Association adjourns, it shall be to meet in the city of Chicago, on the third Tuesday in September, 1877." [1]

The following resolutions were then adopted : —

"*Resolved*, That we offer our cordial acknowledgments to the president and officers of the School of Technology, not only for the gratuitous use of their halls and lecture-rooms, during the sessions of the Association, but also for their personal attentions in promoting its convenience and comfort.

"*Resolved*, That the representatives of the daily press are heartily thanked for their accurate and full reports of the public sessions of this Annual Meeting.

"*Resolved*, That this Association, before its adjournment in the chief city of the State which has first and most largely illustrated the public service of a Central Board of Health in a Commonwealth, wishes to express, as the unanimous conviction of its members, that the example and works of the State Board of Health of Massachusetts are tending greatly to promote the progress, sanitary knowledge, organization, and popular support of Public Health Service in the States."

The Association adjourned to meet in Chicago the third Tuesday of September, 1877.[1]

LIST OF MEMBERS ELECTED AT THE FOURTH ANNUAL MEETING.

J. McGregor Adams, Chicago, Ill.
J. Adam Allen, M. D., Chicago, Ill.
Edmund Andrews, M. D., Chicago, Ill.
Elliott Anthony, Chicago, Ill.
B. F. Ayer, Chicago, Ill.
W. B. Bateham, Chicago, Ill.
J. H. Baxter, M. D., Medical Purveyor, U. S. A., Washington, D. C.
Hon. James W. Beekman, New York.
S. C. Blake, M. D., Chicago, Ill.
E. W. Blatchford, Chicago, Ill.
Henry I. Bowditch, M. D., President State Board of Health, Boston, Mass.
L. C. Butler, M. D., President Vt. State Medical Society, Essex, Vt.
Wm. F. Channing, M. D., Providence, R. I.
Henry G. Clark, M. D., Boston, Mass.
Frederick W. Clarke, Civil Engineer, Chicago, Ill.
Edward Cowles, M. D., Boston, Mass.
John Crerar, M. D., Chicago, Ill.
Prof. Francis D. Cunningham, M. D., Richmond, Va.
J. B. Danforth, M. D., Chicago, Ill.
Joseph P. Davis, C. E., Boston, Mass.
Wirt Dexter, Chicago, Ill.
Richard L. Dugdale, New York.
Prof. Theodore W. Dwight, LL. D., New York.
Albert Ebert, Chicago, Ill.
George Engs, M. D., Newport, R. I.
Prof. H. L. Eustis, Cambridge, Mass.
C. E. Fairbank, Chicago, Ill.
John Favill, M. D., Madison, Wis.
Charles E. Felton, Chicago, Ill.
Marshal Field, Chicago, Ill.
L. F. C. Garvin, M. D., Lonsdale, R. I.
F. B. Gaudet, M. D., President Board of Health, New Orleans, La.

[1] By order of Executive Committee this appointment was changed to September 25, 1877.

Prof. Wolcott Gibbs, M. D., Harvard University, Mass.
A. L. Gihon, M. D., Medical Inspector, U. S. Navy, Annapolis, Md.
E. L. Griffin, M. D., President State Board of Health, Fond du Lac, Wis.
John Guerin, M. D., Chicago, Ill.
Rev. Edward Everett Hale, Boston, Mass.
R. C. Hamill, M. D., Chicago, Ill.
Joseph J. Heindl, C. E., Richmond, Va.
Charles S. Hoyt, M. D., Secretary State Board of Charities, Albany, N. Y.
Prof. T. Sterry Hunt, Boston, Mass.
E. S. Isham, M. D., Chicago, Ill.
W. L. B. Jenny, Chicago, Ill.
J. L. Jewell, M. D., Chicago, Ill.
James P. Kirkwood, C. E., Brooklyn, N. Y.
E. C. Larned, Chicago, Ill.
Prof. S. A. Lattimore, Rochester, N. Y.
S. Laughton, M. D., Bangor, Me.
L. Z. Leiter, Chicago, Ill.
R. S. Lincoln, Chicago, Ill.
W. P. P. Longfellow. C. E., Boston, Mass.
Prof. Joseph Lovering, Cambridge, Mass.
Albert Lybrock, Architect, Richmond, Va.
Henry M. Lyman, M. D., Chicago, Ill.
Wm. H. Lyman, M. D., Chicago, Ill.
E. B. McCagg, Chicago, Ill.
Franklin MacVeagh, Chicago, Ill.
B. MacVicker, M. D., Chicago, Ill.
Solon Marks, M. D., Milwaukee, Wis.
Prof. Charles E. Munroe, Naval Academy, Annapolis, Md.
Timothy Newell, M. D., Providence, R. I.
Wm. Nichols, M. D., Boston, Mass.
P. B. Peabody, Chicago, Ill.
Robert S. Peabody, Architect, Boston, Mass.
Henry E. Pellew, Esq., New York.
Dr. Pendleton, Belfast, Me.
E. S. Philbrick, C. E., Boston, Mass.
Prof. Edward C. Pickering, Boston, Mass.
E. Powell, M. D., Chicago, Ill.
G. M. Pullman, Chicago, Ill.
J. T. Reeve, M. D., Secretary State Board of Health, Appleton, Wis.
Prof. J. D. Runkle, President Institute of Technology, Boston, Mass.
F. B. Sanborn, Concord, Mass.
E. H. Sargent, Chicago, Ill.
Ernst Schmidt, M. D., Chicago, Ill.
O. G. Sheldon, M. D., Reedsburg, Wis.
J. Herbert Shedd, C. E., Providence, R. I.
Mark Skinner, Chicago, Ill.
R. L. Starkweather, M. D., Chicago, Ill.
H. P. Strong, M. D., Beloit, Wis.
Francis H. Stuart, M. D., Brooklyn, N. Y.
D. C. Teal, M. D., Ironton, Sauk Co., Wis.
S. H. Tewksbury, M. D., Portland, Me.
J. L. Thompson, Chicago, Ill.
Murray F. Tuley, Chicago, Ill.
B. R. L. Vandoozer, M. D., Chicago, Ill.
George C. Walker, Chicago, Ill.
Jerome Walker, M. D., Brooklyn, N. Y.
Hon. Emory Washburn, Cambridge, Mass.
Octavius A. White, M. D., New York.
Oliver C. Wiggin, M. D., Providence, R. I.
J. S. Williams, M. D., Chicago, Ill.
Norman Williams, Chicago, Ill.
Rev. F. H. Wines, Secretary Commission of State Charities, Springfield, Ill.
Edward S. Wood, M. D., Harvard University, Mass.
Hon. George H. Yeaman, New York.

OFFICERS FOR THE YEAR 1876–77.

President,[1] DR. JOHN H. RAUCH, Chicago, Ill.
First Vice-President,[1] DR. LEWIS H. STEINER, M. D., Frederick City, Md.
Second Vice-President, DR. EZRA M. HUNT, Metuchen, N. J.
Secretary,[1] DR. ELISHA HARRIS, New York.
Treasurer,[1] DR. J. FOSTER JENKINS, Yonkers, N. Y.

ELECTED MEMBERS OF THE EXECUTIVE COMMITTEE.

Prof. Hosmer A. Johnson, M. D., Chicago, Ill.
Dr. Charles F. Folsom, Secretary State Board of Health, Boston, Mass.
Dr. Albert L. Gihon, Medical Inspector U. S. Navy, Annapolis, Md.
Dr. John S. Billings, Surgeon U. S. Army, Washington, D. C.
Jackson S. Schultz, Esq., New York.
Dr. John M. Woodworth, Supervising Surgeon-general U. S. Marine Hospitals.

[1] Ex-officio Members of Executive Committee.